DOCUMENT OF INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT
INTERNATIONAL DEVELOPMENT ASSOCIATION

Not For Public Use

Report No. PTR-123a

APPRAISAL OF

A FOURTH RAILWAY PROJECT

KOREA

October 20, 1972

Asia Projects Department

Currency Equivalents

National Currency is: WON
Basic exchange rate by Bank of Korea as of end of the year given below:

		1967	1968	1969	1970	1971
US$1 =	Won	274.6	281.5	304.45	316.65	370.8*
Won 1 =	US$	0.00364	0.00355	0.00328	0.00315	0.00269
1,000,000 =	US$	3,642	3,552	3,285	3,158	2,697

A rate(US$1 = 400 Won
of (Won 1,000,000 = US$2,500 has been adopted for the period 1972-1976

* end of November

Fiscal Year

January 1 to December 31

Weights and Measures

Metric: British/US Equivalent

1 meter (m)	=	3.28 feet (ft)
1 kilometer (km)	=	0.62 mile (mi)
1 kilogram (kg)	=	2.2 pounds (lb)
1 metric ton (m ton)	=	2,205 pounds

Abbreviations and Acronyms

EPB -	Economic Planning Board
KNR -	Korean National Railroad
MOC -	Ministry of Construction
MOCI -	Ministry of Commerce and Industry
MOF -	Ministry of Finance
MOHA -	Ministry of Home Affairs
MOT -	Ministry of Transport
OECF -	Overseas Economic Cooperation Fund
TCMC -	Transport Coordination Ministers Conference
TCWG -	Transport Coordination Working Group
TPO -	Transport Planning Office

KOREA

FOURTH RAILWAY PROJECT

TABLE OF CONTENTS

This Appraisal Report has been prepared by Messrs. Tachibana, Nanjundiah and Abe and has been edited by Miss V. Foster.

TABLES

ANNEXES

MAP

KOREA

FOURTH RAILWAY PROJECT

SUMMARY AND CONCLUSIONS

i. This report appraises a project for the Korean National Railroad (KNR), with the objective of enabling it to fulfill its economic role and satisfy the long-term requirements of increased traffic brought about by the growth of the economy. The proposed loan of US$40 million equivalent would be the fourth Bank Group lending for KNR; the first was in 1962 (Credit 25-KO) and amounted to US$14 million equivalent. IDA Credit 110-KO (US$11 million) and IDA Credit 183-KO/Loan 669-KO (US$55 million) supported KNR's Investment Plan during the second Five-Year Plan period (1967-1971). These aided in the establishment of KNR as a semi-autonomous agency within the Government and the expansion of rail capacity to cope with the sharply rising transport needs accompanying the rapid growth of the economy.

ii. The very rapid expansion in income, production and international trade of Korea in recent years has placed severe pressure on the transport system. Government investment in transport increased significantly in the second Five-Year Plan period (1967-1971). However, transport capacity still needs to be augmented to meet the present and anticipated future demands. In addition to the assistance for the railway mentioned above, the Bank Group made a credit of US$3.5 million (S4-KO) in 1968 for highway studies and a study of transport organization and coordination, which was later incorporated into a loan of US$54.5 million (Loan 769-KO) in 1971 for a highway project. The Bank is the Executing Agency for a UNDP-financed ports study currently under way.

iii. The evolution to a multi-mode transport system has diminished the dominant role of KNR. However, KNR will continue to perform an important economic role, particularly as a carrier of bulk commodities and production in addition to significant passenger traffic. With the growth of the economy, industrialization and urbanization, the capital, Seoul City (with a present population of over 5.5 million), is in urgent need of a mass rapid transit system to relieve the traffic problems of the metropolitan area. KNR will play an important role in alleviating this transport problem and plans to electrify railway services in the Seoul suburban area to provide the requisite services and aid in decentralization of the population.

iv. The project, costing an estimated US$265 million equivalent, consists of the first three years of KNR's US$339.5 million 1972-1976 Investment Plan. The main items of the project constitute electrification of KNR lines in the Seoul suburban area and provision of electric railcars (23%); completion of the already started electrification (including acquisition of electric locomotives) of 350 km of KNR lines connecting Seoul with the northeastern part of Korea where coal and cement industries are located (22%); track and bridge renewals and strengthening (10%); provision of yard facilities and some capacity increases in stations (13%); acquisition of freight cars and passenger cars (16%); and improvement of facilities for maintenance and repair of motive power and rolling stock (3%). The balance consists of

miscellaneous items (13%). The proposed loan would finance specific goods, mostly imported, procured through international competitive bidding: track materials, bridge girders, track equipment, 271 passenger coaches, 5 breakdown cranes, and plant and machinery for workshops and sheds. Should Korean firms win contracts for constructing ordinary passenger cars and supplying bridge girders, disbursements from the proposed loan would be made against the total costs of these, including the local cost component. Such local cost financing is not expected to exceed US$8 million equivalent. The total foreign exchange component of the project amounts to an estimated US$156.5 million equivalent. This is to be financed by the proposed loan of US$40 million, a special Yen credit allocation of about US$35 million equivalent for the Seoul suburban electrification scheme, US$15 million from Credit 183-KO/ Loan 669-KO, about US$54 million equivalent from bilateral sources and the balance from Government, mainly for contingencies on financing from non-bank sources. Most of the local costs would be provided by Government, since KNR's financial situation does not enable it to finance investments from internally generated funds. The provision of adequate funds by Government to KNR was agreed to during negotiations.

v. The Investment Plan, including adequate yard facilities in the Seoul area, was agreed to by KNR, the Government and the Bank during negotiations. It was also agreed during negotiations that no substantial changes would be made in the Investment Plan without agreement with the Bank.

vi. The management of KNR is generally satisfactory, and the efficiency of operations is high. Maintenance of property and equipment is satisfactory. However, for full implementation of commercial accounting adopted from 1971, there is need for procedural improvements, and measures for this were agreed upon during negotiations.

vii. The Investment Plan and the project have been found to be technically and economically justified. The economic rate of return for the Plan investments is about 20%. The financial position of KNR has deteriorated and, in 1971, there was an operating deficit rather than a rate of return of 7% as specified in Credit 183-KO. A decline in passenger traffic, slower freight traffic growth than anticipated, and rise in costs without any compensating tariff adjustments have caused this situation. To remedy it, Government allowed KNR to increase its freight tariffs by an average of 20% from February 1972; some commuter passenger fares were also raised. These measures would enable KNR to have a small operating surplus in 1972, but are insufficient to improve KNR's finances adequately. Further freight tariff adjustments are needed (no revision of passenger tariffs is proposed for another two years in view of the competitive position and the fact that they now cover full costs). This question was discussed with KNR and Government during negotiations and specific financial targets and tariff measures have been agreed upon.

viii. The proposed project provides a suitable basis for a Bank loan of US$40 million equivalent to the Republic of Korea for a term of 25 years, including a four-year period of grace. The loan should be passed on to KNR as beneficiary on identical terms.

KOREA

FOURTH RAILWAY PROJECT

1. INTRODUCTION

1.01 The Government of the Republic of Korea and the Korean National Railroad (KNR) have asked the Bank for a loan of US$40 million equivalent to finance part of the foreign exchange cost of KNR's Investment Plan for 1972-1974, which is part of the third Five-Year Economic Development Plan of Korea, 1972-1976. KNR's investments during these three years are estimated at Won 105.9 billion (US$264.8 million equivalent), with a foreign exchange component of US$156.5 million equivalent. The Plan and the project are designed to enable KNR to satisfy the requirements of increased traffic which it would have to carry with the growth of the economy. The project includes the completion of electrification of 350 km of lines (carrying heavy bulk traffic) started under the last Plan, electrification of some lines in the Seoul suburban area, acquisition of passenger cars and freight cars, track and bridge strengthening and renewal, provision of marshalling yard facilities and rolling stock repair facilities. As in previous Bank Group lending operations for KNR, the proposed loan would be made to the Republic of Korea to be utilized by KNR, which is a Government enterprise; the loan would finance specific goods, mainly imported; other foreign currency requirements would be covered by various bilateral arrangements and from the Government's own foreign exchange resources.

1.02 The Bank Group has helped finance three previous railway projects in Korea: Credit 25-KO, US$14 million equivalent, in 1962; Credit 110-KO, US$11 million equivalent, in 1967; and Credit 183-KO/Loan 669-KO, US$55 million equivalent, in 1970. These helped to establish KNR as a separate entity with appropriate powers and, by modernization of the railway and expansion of its capacity, enabled it to play a vital role in the Korean economy and handle the sharp increases in traffic generated by rapid economic growth. Performance on these projects has been generally satisfactory and KNR has maintained a high level of operational efficiency. However, deliveries of some items included in the third project have been carried over; freight cars, telecommunication equipment and certain track equipment covered under the last loan are now expected to be received during 1972 and 1973. KNR's financial situation deteriorated in 1970 and 1971. Some tariff measures have been taken in 1972 by Government and KNR to remedy the situation, but these are inadequate and further specific measures were agreed upon during negotiations.

1.03 The other Bank Group assistance for transportation in Korea has consisted of a grant of US$200,000 in 1965 for a Transportation Survey, a credit (S4-KO) for US$3.5 million in 1968 for highway and transport coordination studies, which was incorporated into a loan of US$54.5 million (Loan 769-KO) in 1971 for a highway project. The latter includes the construction of 372 km of a primary national highway; some feasibility and detailed engineering studies; a highway maintenance study and establishment of a highway maintenance organization in a "pilot" province. The Bank is also the

Executing Agency for a UNDP-financed ports study currently under way; the study is likely to result in a project suitable for future Bank financing.

1.04 This appraisal is based on information supplied by the Government of Korea and the Korean National Railroad and on the findings of the December 1971 Bank appraisal mission, composed of Messrs. Tachibana, Nanjundiah and Abe. The report was prepared by them and edited by Miss V. Foster.

2. BACKGROUND

A. Transport Sector

2.01 The very rapid expansion of income, production and international trade in Korea has been accompanied by growing transport demand. During the period 1962-1970, gross national product increased by nearly 11% per annum, the value of exports by 30%, and that of imports by 25%. As part of this growth, domestic passenger traffic in all modes, in terms of pass-km, increased by about 11% annually, freight traffic in ton-km by about 13% and international traffic by 22%. Due to rapid economic growth and to relatively modest investments in the transport infrastructure during the first Five-Year Plan period (1962-1966), the overall transport system capacity was severely strained. The situation improved during the second Five-Year Plan period, with active investment in the railroad and the development of highways, as well as road transport and coastal shipping. Transport capacity still needs to be augmented, however, to meet present and anticipated future demands.

2.02 The Korean transport system is influenced by the hilly nature of the country (about two-thirds of the land surface is hilly); the concentration of economic activity and population around the Seoul-In Cheon and Pu San areas; the location of domestic natural resources e.g., coal, iron ore and limestone, in the north, northeast and center of the country; a long coastline with increasing industrial activity; and important economic dependence on exports of manufactured goods and imports of bulk raw materials.

2.03 The growth of traffic in each mode is shown in Table 1. KNR has been handling substantial quantities of bulk and industrial commodities and considerable passenger traffic, although its share of the total traffic has been decreasing. Road transport has the largest share of passenger traffic (66% in 1970) and has captured the bulk of the increase in traffic. During 1962-1970, total pass-km by all modes increased from 11.5 to 30.3 billion, and 77% of the increase was accounted for by road transport. KNR continued to handle the bulk of freight traffic (58% of the total freight ton-km in 1970), but there has been a large increase in coastal traffic. Of the total freight traffic increase in ton-km during 1962-1970, 46% accrued to coastal shipping, 43% to KNR and 11% to the highway. There was a spectacular growth in port traffic, due mainly to increases in imports of bulk commodities such as oil, grain and lumber and in coastal cargoes such as fuel, coal and cement.

2.04 The physical aspects of KNR are described in Chapter 3 and those of other modes in Annex 1. Road transport is characterized by the limited length of paved roads (about 10% of the total network) and the relatively small number of vehicles (one vehicle per 247 persons in 1970) for Korea's level of economic development. The limited length of network is due mainly to the low priority given to roads until 1968 and the fact that, since that time, a large part of the highway funds was allocated to the construction of two four-lane toll expressways - Seoul-Pu San (428 km) and Seoul-In Cheon (29.5 km). Most of the roads are badly aligned, narrow, poorly drained and either roughly surfaced with gravel or unsurfaced. The small number of vehicles in the country reflects the restrictions on their importation, which had severely limited the number available until 1967, when domestic assembly was started.

2.05 The infrastructure in ports also has capacity limitations. Currently, the most important ports are those at In Cheon and Pu San, and both of them are chronically congested. The Government has been constructing various ports recently to serve new industrial complexes, e.g., Pohang, Ul San, and Ma San. A development study of Korea's main ports is currently under way, with UNDP financing; the Bank is the Executing Agency for the study.

2.06 The role of coastal shipping has been increasing (32% of the total freight traffic, in ton-km, in 1970) due mainly to the construction of industrial complexes on coastal locations and the shortage of rail and road capacity.

2.07 Korea, like other countries, has been aiming at achieving a greater share of merchant shipping. About 24% of the total foreign trade tonnage has been carried by Korean vessels during the past three years.

2.08 Air transport remains comparatively unimportant. The privately owned Korean Airlines (KAL) provides domestic and some international flights; Korea is also served by other international airlines. Most traffic is handled at the Seoul-Kimpo International Airport. Air freight traffic is minor.

B. Transport Investment and Coordination

2.09 Recognizing the inadequacy of the investments in the transport infrastructure during the first Five-Year Plan period, which created bottlenecks in transport, Government increased the allocation for transport infrastructure in the second Five-Year Plan (1967-1971), to about 26% of the total capital formation. However, the use of funds was not always in accordance with economic priority because alternative solutions were not studied. Transport planning and coordination have been inadequate. Responsibility for planning has been scattered; the Ministry of Construction (MOC) has been responsible for road and port construction, and the Ministry of Transport (MOT) for airports, the railways, shipping and road transport regulations. The Economic Planning Board (EPB) has been the only organization in a position to coordinate transport investments, but it has not been staffed for this purpose. Annex 2 describes the functions of different agencies related to the transport sector.

2.10 To provide a basis for improving transport planning and coordination, a study was financed under Credit S4-KO and carried out by consultants SCEOM/NEDECO (France/Netherlands). Based on this study, Credit Agreement 183-KO provided that measures to achieve adequate coordination in transport would be agreed with the Bank Group. The consultants' final report (May 1970) suggested, as a long-term solution, placing responsibility for all transport modes under one Ministry. This was not acceptable to Government. Toward the end of 1969 and the beginning of 1970, Government set up a three-tiered organization responsible for transport planning and coordination: the Transport Coordination Ministers Conference (TCMC), the Transport Coordination Working Group (TCWG) and the Transport Planning Office (TPO) within MOT (Annex 2). It was intended that TPO would be responsible for undertaking economic analysis and rendering professional advice to TCMC on investment planning and important policy measures including licensing, pricing and taxation within the subsectors of transport. However, substantive issues relating to investment planning and policy measures have not received adequate attention, despite their importance in view of the expected large investments in the transport sector during the Plan period (about 24% of total capital formation).

2.11 Organizational changes as a means to improve transport planning and coordination can have effect only if the need therefor is fully realized and accepted, and there is a change in the general attitude. TCMC meets only rarely and senior Government officials have only recently begun to realize the importance of transport planning and coordination. Successful economic development in the past, with economic policies largely dictated at a high level and carried through with tenacious regard for physical achievements, makes it difficult to expect changes in attitudes, except gradually. The effort to convince the Government at the higher level of the need for proper planning and coordination should be continued; meanwhile, in the immediate term there are certain areas in which improvement is required and where specific action is feasible. This matter was discussed during negotiations and an action program agreed upon. To make the work of TCMC, TCWG and TPO more effective even within the present organizational structure, the functions and work program of TPO, including the collection and preparation of sound data relating to costs and operation of all modes of transport, will be reviewed and TPO will furnish periodical reports thereon to the Bank. Also, there is to be an early strengthening of the economic expertise in TPO by direct appointment and/or training. (This is also partly covered by the financing of training of TPO staff under the First Highway Loan, Loan 769-KO, 1971.) Further, a Government directive will be issued to all relevant Government agencies including MOC to ensure that all major investment proposals related to transport are passed to TPO for economic appraisal and coordination purposes.

3. THE KOREAN NATIONAL RAILROAD

A. Organization, Management and Staff

3.01 In 1963, in accordance with the Government Organization Law required under Credit Agreement 25-KO, KNR was established as a semi-autonomous agency within the Government with an independent manager and its own budget and accounting (Organization Chart of KNR, Annex 3). Government exercises control over KNR in staff, financial and budgetary matters. KNR has been given greater autonomy in financial matters since 1970/71, following the agreement reached at the time of the sanction of the last loan and credit.

3.02 The management of KNR is generally satisfactory. Shortage of senior qualified engineering, economic and accounting staff, coupled with the size and complexity of KNR's investment program, led to extensive employment of consultants to study several aspects of railway operation and investment needs. Consultants (from Japan) are employed by KNR in connection with the electrification of KNR lines in the Seoul suburban area as part of the rapid transit project for the Seoul metropolitan area. A program for training of selected KNR operational and engineering staff at intermediate level is currently under way and is satisfactory. Training of accounting staff in the implementation of the commercial accounting system needs to be continued and carefully watched by KNR management; this question was discussed with KNR during negotiations and it was confirmed that the training program is proceeding satisfactorily.

3.03 The level of staff remuneration in KNR has been lower than that of industrial and commercial enterprises in Korea. To improve the position and ensure that sufficient qualified personnel are available, KNR has, at Government direction and in common with other Government enterprises, progressively increased salaries and other remuneration. Increases of 30% from July 1969 and further increases of 20% from April 1970, 15% from April 1971 and 15% from April 1972 have been sanctioned to KNR, as for other Government employees. These measures, together with other factors such as status as Government employees, have enabled KNR to retain sufficient qualified personnel. Even with these increases in wages and salaries, the total staff costs in 1971 were only about 41% of operating expenses, which is low in relation to other railways.

3.04 The number of permanent employees with Government employee status was about 34,900 in 1971; this was less than the peak figure of 35,684 employees in 1969. In addition to the permanent employees, KNR employed about 3,300 workshop personnel, 1,070 security personnel and 3,800 temporary personnel. The traffic unit (ton-km + pass-km) per employee (taking total employees) during 1971 was 385,000, which is good compared with most other railways (Malaysia 165,000; Columbia 122,000; Egypt 130,000; New Zealand 150,000). There is, however, scope for further improvement in efficiency and some mechanization, both of which are in progress and should be aided by the implementation of the investments under the proposed project. KNR plans some further reductions in staff strength.

3.05 There is only one labor union, and relations with management are good. In general, the staff displays excellent discipline and industriousness.

B. Railway Property

3.06 The present position with regard to railway property and the context in which improvements are now planned are described in Annex 4. It will be seen that track has been generally well maintained. With the growth of traffic, however, especially on the double track main lines and the lines from Seoul to the northeastern part of Korea (the industrial lines) which carry heavy volumes of bulk commodities and are being electrified (Map), a change in maintenance procedures is necessary and the track must be improved. This, together with bridge renewals and strengthening on these lines, is now planned. Modernization of signalling and telecommunication facilities is also required and is being undertaken. It will be seen that marshalling yard facilities, particularly in the Seoul area, need to be augmented; in the light of consultants' studies made by Touche Ross & Co. (Canada), the plans of KNR, after the revision of their proposals regarding the new connection to the second In Cheon port, were inadequate to cater to these requirements. This question was discussed with KNR during negotiations and provision of suitable facilities included in KNR's investment Plan.

3.07 KNR's motive power and rolling stock position at the end of 1971 is given in Table 2. KNR is mostly dieselized, but has some steam locomotives which would phased out by 1974 (except for 7 locomotives for narrow gauge lines and 17 reserved for emergency use). Electric locomotives will be introduced in 1972 and their number will go up to 66 by 1974. About 400 (approximately 25% of the total fleet) of KNR's passenger cars are over-aged Manchurian railways' or second-hand American railways' cars in poor condition; their replacement is now planned. About 2,300 freight cars are over 30 years old and are in poor condition. They are to be replaced during the Plan period.

3.08 KNR's facilities for maintenance and repair of locomotives and rolling stock need to be improved and reorganized (Annex 4). KNR's plans regarding reorganization of Seoul workshop (which will, in the future, undertake repair of electric railcars used in suburban service and electric locomotives) should be reviewed from the overall coordination point of view by the consultants (Japanese) engaged in connection with the Seoul suburban electrification project. Agreement was reached with KNR regarding this matter during negotiations.

C. Traffic and Operations

(i) Freight traffic

3.09 KNR's freight traffic statistics from 1964 through 1971 are shown in Table 3. During this period, freight traffic grew about 7% per annum in tonnage and 8% per annum in ton-km. This growth was mainly attributable to increases in commercial traffic (as distinct from military and KNR's service freight) which grew annually at 8% in tonnage and 9% in ton-km. The average

freight transport distance increased from 223 km in 1964 to 245 km in 1971, due mainly to the recent development of industrial complexes away from traditional traffic centers.

3.10 Bulk commodities including coal, cement, oil, ore, fertilizer and grains constituted 82% of KNR's total freight ton-km in 1971. The composition of the bulk commodities in KNR's commercial traffic in 1971 was as follows:

	tonnage		ton-km
	million tons	%	%
Coal	12.1	41.6	39.5
Cement	5.8	19.9	16.8
Oil	2.5	8.6	9.9
Ore	1.6	5.5	5.8
Grain	1.4	4.8	5.5
Fertilizer	1.1	3.8	4.7
Subtotal	24.5	84.2	82.2
Others	4.6	15.8	17.8
Total	29.1	100.0	100.0

"Others," which consists mainly of general goods suitable for highway transport, declined from 5.8 million tons in 1968 to 4.6 million tons in 1971. Part of this decline was due to a shortage of motive power and freight cars, which eased only in the latter part of 1971; part was due to development of highway transport. Coastal shipping was also used, especially for coal and cement; the Government allowed some subsidies to consignors for such coal movements. With the easing of rail transport capacity in 1971, rail traffic in coal increased and the subsidies were discontinued.

3.11 The most dense sections of KNR lines for freight traffic are between the Seoul area and the northeastern part of Korea - the "industrial lines," which carry large volumes of coal and cement. These are followed in density by the lines between Seoul and Pu San (density chart, Annex 5). Freight net ton-km per route-km of KNR was 2.44 million in 1971.

3.12 KNR freight traffic in 1972 is now expected to be lower than in 1971 due mainly to a slower growth in the economy and an interruption in the rail traffic on the industrial lines caused by flood damage to the track in August 1972. Freight traffic, in tonnage, is expected to increase on average

about 5.8% per annum during 1973-1976, with commercial traffic growth (excluding military and service) averaging 6.0% per annum. In 1976, freight traffic is expected to reach 40 million tons as against 32 million tons in 1971. This growth rate would be lower than the rate of growth in 1964-1971, reflecting the diversification of the economy and the increased role of other modes of transport. Table 4 shows the freight traffic forecast, which also takes into account the expected developments in the production and distribution of coal, cement and other industries. Although the bulk commodities will continue to be of prime importance to KNR freight traffic (85% of commercial freight ton-km), the composition of such commodities is likely to be somewhat different in 1976. The proportion of total freight movements accounted for by fertilizer and cement is likely to increase, while the relative proportions of coal and oil may go down.

(ii) Passenger Traffic

3.13 Table 5 shows KNR's passenger statistics from 1964 to 1971. During the period 1964-1969, passenger traffic increased by 5.5% per annum in number of passengers and by 8.5% in pass-km, mainly attributable to long-distance passengers. Passenger traffic has been sensitive to changes in passenger fares; a fare rise of about 30% in 1970, at the same time as the highway improvements and the opening of the Seoul-Pu San expressway (428 km), with a large number of air-conditioned buses put into operation, resulted in a sharp reduction in the non-commuter rail passenger traffic. In 1971, the long-distance passenger (other than military passenger) traffic declined to 85.2 million in number of passengers and 7.3 billion pass-km as against 114.8 million passengers and 9.7 billion pass-km in 1969. Expressway bus passengers in 1971 are estimated at 22 million passengers and 3.1 billion pass-km.

3.14 The major factors which affect the relative use of expressway buses and rail passenger services seem to be the fares charged, the frequency of services, and the degree of comfort offered to the passengers. KNR runs no less than 20 passenger trains a day each way between Seoul and Pu San (for parts of this line the number is much greater) and eight of these - five limited express trains and three super express trains - are slightly faster than the expressway buses which take about six hours to cover the distance between Seoul and Pu San (428 km). The expressway buses, however, are more frequent, and the fares charged in 1971 between Seoul-Dae Jeon and Seoul-Pu San generally approximated the limited express train fares even though they offered air-conditioned accommodations, not provided on the limited express trains. These factors contributed to the diversion of some rail passenger traffic to the expressway buses. Even with the diversion, however, the occupancy of KNR trains has been generally good, although it has dropped; the overcrowding of the trains has been reduced. KNR is making efforts to improve the quality of its service - i.e., better ticket sale facilities, more convenient timings, better cars and facilities. KNR's costs for passenger traffic are low (on an average less than US¢1 per pass-km). Passenger fares, however, have been well above fully distributed costs. In view of this, KNR does not propose to increase its passenger fares for the present and has recently reduced fares selectively. Fares charged by expressway buses were raised by about 23% from February

1972 but some selective reductions have been made from June 1972. Some of the long distance passenger traffic could be expected to come back to the railway, as indicated by the trend so far in 1972.

3.15 KNR commuter traffic around the major cities is significant but does not cover even variable costs (paras. 3.25 and 3.26). In 1971, it represented 32% of the total number of passengers and about 11% of the pass-km, a large part in the Seoul suburban area. With the rapid growth of population in Seoul (present population about 5.5 million) and the need to alleviate the traffic congestion, a mass rapid transit project covering the construction of a subway by Seoul City and electrification of KNR lines in the Seoul suburban area has been taken up, with technical and financial assistance from Japan. The electrification of KNR's Seoul suburban lines is expected to be ready in 1974. After the completion of the subway and KNR electrification, commuter traffic on KNR will increase sharply, as traffic carried by local buses and taxis in the congested city will divert to rail and subway (for the effect on KNR finances, see para. 6.12). The average distance traveled by commuters will drop as a result.

3.16 Passenger traffic forecasts are given in Table 5. They incorporate the effect of the increase in commuter traffic after suburban electrification and the recent trend in KNR passenger traffic, which registered a 19% increase in passenger km during the first half of 1972. Commuter traffic is expected to rise to 150 million passengers and 1.65 billion pass-km in 1976; long distance (including military) traffic is expected to increase to 102.7 million passengers and about 9.6 billion pass-km in 1976. Long distance passenger traffic, however, is expected to rise only slightly as the paving program and the construction of expressways continue, especially in sections other than Seoul-Pu San and the Seoul suburban area.

(iii) Operations

3.17 Table 6 gives a summary of operating statistics from 1967 to 1971. It shows that operating efficiency is generally good. Steam traction is mostly confined to shunting services, and only about 1.5% of the train-km are steam operated (against 36% in 1963); steam operation will be practically eliminated (except for use of seven locomotives on narrow gauge) by 1974, when the electrification of industrial lines is completed.

3.18 The availability of diesel locomotives at 88% in 1971 is satisfactory, but can be further improved by adequate repair facilities and increased attention to the provision for stores and spares. The daily output of 429 km per engine available is good. Availability of diesel railcars is only 67% and needs improvement. KNR is aiming at an availability of 85% and intends implementing the recommendation of the consultants (Touche Ross & Co.) regarding provision of components, replacement of some engines, etc.

3.19 The utilization of passenger cars is good. The average daily run per passenger vehicle available is 330 km; the pass-km per annum per vehicle available is nearly 6 million, which can be attained only with a high occupancy of passenger cars. KNR will have to improve the quality of its passenger service, especially in the increasingly competitive situation, and

such improvement would tend to bring down these figures. The availability of passenger cars, 84% in 1971, needs improvement. The workshop and running shed facilities now planned and the acquisition of new cars to replace over-aged cars in poor condition should enable the availability to increase to 90% by 1976.

3.20 Freight cars carry close to their effective capacity; the average load of freight cars has increased from 33.4 tons in 1967 to 37.8 tons in 1971. Freight car productivity of 580,000 ton-km per freight car available in 1971 was very high compared with other railways (Germany 235,000; France 251,000). This is excellent performance from a statistical point of view, but it is also a sign that demand exceeds supply and customer service is likely to be affected. With growing competition, KNR must further improve the quality of its service.

3.21 To maintain a good operating performance and ensure optimum utilization of the rolling stock, improvement in marshalling yards, installation of adequate loading and unloading facilities, signalling improvements etc. would be needed. KNR's efforts to improve operations include the recent introduction of more block trains for coal movement.

D. Tariffs and Costs

3.22 KNR, in common with all Government enterprises, must have its tariffs approved by the Government, after a review by a rate-making "Committee for Decisions on Utility and Public Enterprise Commodity Rates" headed by the Deputy Prime Minister; tariffs approved by the Government are incorporated in KNR's budgets, which are subject to approval by the National Assembly.

3.23 Details of the freight rate and passenger fare structure are given in Annex 6. Tariffs are generally low; tariff increases granted during the second Five-Year Plan period (1967-1971) were as follows:

	Freight rates	Passenger fares
October 1, 1967	30%	50%
May 1969	15% accompanying change in commodity classification	
December 1969		30%

The tariff increases have barely matched cost increases in the case of freight rates, which have been held at low levels as a matter of policy (Government also exercises control on the prices of essential commodities). The average revenue per ton-km of Won 1.5 in 1971, equivalent to only US¢0.65 per ton-km, is low by any international standard. During 1970 and 1971, average revenue per ton-km, in terms of constant 1967 Won, was less than in 1967, thus indicating a decline in freight rates, in real terms.

3.24 A high degree of utilization of rail facilities and rolling stock maintains the costs at a generally low level. A traffic costing study (1970) made by the consultants (Touche Ross & Co.) showed the 1968 costs and suggested some improvements in traffic costing procedures employed by KNR. These recommendations are proposed to be implemented by KNR, but progress has been slow on account of staff and training problems. Recently, however, KNR has trained some staff and strengthened the costing section. KNR's analysis of costs indicated that, during 1970, the average fully distributed costs were about 1.4 Won (US¢0.38) per pass-km and 1.9 Won (US¢0.51) per freight ton-km (in current Won). These costs are slightly understated, as KNR's provision for maintenance was below the optimum level and the depreciation provision was also somewhat understated. Even allowing for these, the costs of rail transport are low.

3.25 The studies also show that commuter traffic did not cover even variable costs, but other passenger fares have been well above fully distributed costs; freight rates, although generally covering variable costs, have been below full costs. In view of growing competition, KNR should correct the present situation of excessive dependence upon passenger traffic for its net revenues while carrying substantial quantities of freight traffic, mostly bulk commodities, which do not make adequate contribution to the fixed costs. The consultants (Touche Ross & Co.) made some suggestions regarding needed freight tariff changes.

3.26 Under Credit 183-KO, KNR was required to revise the tariffs, taking account of the consultants' recommendations, information obtained from traffic cost analyses and the conditions of competition from other modes of transport. Such revision was to be effective by July/August 1971. However, Government allowed KNR to make freight tariff increases only from February 1972. These changes are expected to raise the average tariff by 20%. In addition to the freight tariff increases, KNR also increased mail carriage charges and commuter passenger fares, by reducing the discounts to students and general commuters (see Annex 6 for details of changes); effective commuter fares are now likely to cover variable costs. These tariff changes are, however, insufficient to adequately improve the financial situation of KNR, which deteriorated in 1971 (Chapter 6). Further freight tariff adjustments are urgently needed. The tariff structure has somewhat improved, but further improvement is needed. Passenger tariffs should not be increased at this time in view of the competitive situation and the fact that they cover full costs.

E. Budget, Accounts and Audit

3.27 Until recently, KNR maintained accounts and prepared operating and capital budgets in two forms, one as laid down for Government departments and the other based on an enterprise accounting system (commercial) installed by the consultants (Booz, Allen and Hamilton International) financed under Credit 25-KO. This led to insufficient attention to commercial accounting and duplication of work. As agreed under Credit 183-KO, Government authorized KNR to abandon the Government form of accounting from January 1971 and to maintain its accounts and financial statements solely in accordance with the commercial accounting system. However, the actual progress of KNR in fully

implementing the system is slow. The external auditors who examined KNR's 1970 accounts during 1971 have drawn attention to several procedural and internal check deficiencies, besides some routine inaccuracies. The procedural deficiencies indicate that the system has not been designed in sufficient detail. To assist in rectifying the position and implementing commercial accounting and mechanization of accounting work, it was agreed during negotiations that KNR would obtain the services of Consultants acceptable to the Bank upon terms and conditions satisfactory to the Bank. A time phased program would be drawn up, with the assistance of Consultants, for full implementation of the system by January 1975.

3.28 KNR's budgets are subject to approval of the National Assembly; budgets are very detailed. Increased powers were delegated to the Director General of KNR in mid-1970. The Economic Planning Board (EPB) reviews the budget allocations quarterly; this action has no adverse effect on its operations. Apart from KNR's capital budget, funds are sometimes allocated from the "Economic Development Special Account" to KNR (as to other enterprises), usually in the form of grants, for investments required from an overall point of view. Besides this, a separate "Railroad Fund" has been established under a special law; some projects are taken up from this, outside the normal budget, e.g., development of land for commercial purposes and the construction of the "Transport Center" building in Seoul, which also houses KNR's headquarters offices. KNR's accounts are audited by independent auditors as required under Credit 183-KO.

4. THE PLAN AND THE PROJECT

A. The Plan

4.01 KNR's Investment Plan forms part of the third Five-Year Economic Development Plan of Korea, 1972-1976. This Plan was discussed and agreed with KNR and Government during appraisal but subsequently KNR advised a change regarding the In Cheon port line. With this revision, there was need for a substitute provision in order that marshalling yard facilities in the Seoul area would be adequate (Annex 4). The question was discussed with KNR and Government during negotiations and the Investment Plan suitably revised. The Investment Plan 1972-1976 as now agreed between the KNR, Government and the Bank involves a total investment of Won 135.8 billion (US$339.5 million equivalent) with a foreign exchange component of US$180.9 million equivalent. This includes works carried over from the 1967-1971 Investment Plan, such as electrification of industrial lines, yard facilities etc. It was also agreed during negotiations that substantial changes in the Plan would be made only with the agreement of the Bank.

4.02 The composition and cost of the works now included in the Plan are shown in detail in Table 7, a summary of which is given below (see Annex 7 for a description of the main items):

	Won Billion			US$ Million			% of Total
	Local	Foreign	Total	Local	Foreign	Total	Expenditure
(1) New line construction	1.18	0.28	1.46	2.94	0.71	3.65	1.1
(2) Electrification							
(a) Industrial lines	4.37	5.53	9.90	10.93	13.82	24.75	7.3
(b) Seoul suburban area	9.45	6.66	16.11	23.62	16.66	40.28	11.9
(3) Increase in station and line capacity	13.98	3.99	17.97	34.96	9.96	44.92	13.2
(4) Way and structure renewals and improvement	8.78	8.71	17.49	21.95	21.78	43.93	12.9
(5) Motive power and rolling stock	9.89	39.42	49.31	24.72	98.54	123.26	36.3
(6) Motive power and rolling stock repair facilities	1.96	1.67	3.53	4.89	4.18	9.07	2.7
(7) Miscellaneous	5.45	1.14	6.59	13.62	2.86	16.48	4.8
(8) Total - 1 to 7	55.06	67.40	122.46	137.63	168.51	306.14	90.2
(9) Contingencies	8.40	4.94	13.34	21.02	12.35	33.37	9.8
(10) GRAND TOTAL	63.46	72.34	135.80	158.65	180.86	339.51	100.0

4.03 The Plan as now drawn up is conservative with regard to freight car and passenger requirements and assumes continued high utilization as at present. (See Tables 8 and 9 showing calculations of requirements and Table 10 indicating stock at end 1974 and 1976.) Better yard and terminal facilities and signalling improvements with the planned investments may make this possible; however, the need for improvements in the quality of service may make the acquisition of some more freight cars and passenger cars desirable, especially in the latter part of the Plan period. It was agreed during negotiations that the situation should be reviewed by KNR in early 1974, in consultation with the Bank.

B. The Project and the Proposed Loan

4.04 The project consists of the first three years of KNR's Investment Plan 1972-1976 (Table 11). It includes the completion of the electrification of industrial lines already started, electrification of KNR lines in the Seoul suburban area as part of the rapid transit project for the Seoul metropolitan area (Annex 8); construction of a connecting link to the second In Cheon port; installation of Centralized Traffic Control (CTC) in the Seoul area; improvements to marshalling yards and freight handling facilities; complete track and rail renewals; procurement of track maintenance and renewal equipment; bridge strengthening and renewal; acquisition of passenger and freight cars (including 1,949 cars already ordered and being financed under Credit 183-KO/Loan 669-KO); improvement of facilities for repair of motive power and rolling stock; and provision of essential telecommunication facilities (also financed under Credit 183-KO/Loan 669-KO). The total cost of the project is estimated at Won 105.9 billion (US$264.8 million equivalent) with a foreign exchange component of about US$156.5 million, of which US$40 million would be covered by the proposed loan. A breakdown of the estimated project expenditure and items to be financed by the proposed loan are summarized in the following table:

	Project expenditure 1972-1974 US$ million equivalent		Loan Items US$ million
	Total Cost	Foreign Cost /1	
1. New line construction	3.65	0.71	-
2. Electrification			
(a) Industrial lines electrification	23.75	13.82	-
(b) Seoul suburban electrification	40.28	16.66	-
3. Increase in station and line capacity			
(a) Signalling	16.18	6.35	-
(b) Double tracking of Honam Line (25 km)	3.30	0.45	-
(c) Other works /2	15.42	1.65	1.65 /3
4. Way and structure renewals and improvement	27.06	14.76	11.81
5. Motive power and rolling stock			
(a) Electric locomotives (66)	34.60	34.60	-
(b) Electric railcars (126) and spares	18.41	18.41	-
(c) Freight cars (2,449)	24.09	13.35	-
(d) Passenger cars (271)	18.12	18.12	18.12
(e) Breakdown cranes	1.37	1.37	1.37
(f) Other	2.02	0.88	-
6. Motive power and rolling stock repair facilities	8.57	4.18	4.18
7. Miscellaneous	10.72	2.85	-
8. Total 1 to 7	247.04	148.16	37.13
9. Price Contingencies	17.72	8.37	2.87
10. GRAND TOTAL	264.76	156.53	40.00

/1 In this table, passenger cars and bridge girders have been taken as fully imported.

/2 See Table 11 for details.

/3 Consists of rails for line capacity increase.

4.05 Investments included in the project but not selected for the proposed loan either will be financed by other sources or are unsuitable for Bank financing, since it is not proposed to adopt international competitive bidding procedures.

4.06 The project costs are based on latest prices and are reasonable. Contingency provision has been made on the basis of price increases of 6% per annum in regard to local costs and 4% per annum in regard to foreign currency costs, except where firm price contracts have been entered into already (e.g., freight cars financed under Credit 183-KO/Loan 669-KO) and in the case of the Seoul suburban electrification scheme (where provision for contingencies is already included in the costs which are largely financed from a specific Yen credit). Price contingencies now represent about 7.5% of total project costs. No separate provision for physical contingencies is necessary considering the nature of the items included and the fact that the KNR budget is expressed more in monetary than in physical terms.

4.07 As shown in detail in Table 12, procurement of rails and track material, track equipment, bridge girders and erection equipment, plant and machinery for workshop and running sheds, passenger cars and breakdown cranes would be covered under the proposed loan.

4.08 KNR is competent, with the help of consultants already engaged for the telecommunications study and the electrification of suburban lines, to carry out the project.

C. Procurement and Disbursement

4.09 All items to be financed by the proposed loan would be acquired through international competitive bidding. Local firms would be in a position to bid for bridge girders (estimated cost approximately US$1.2 million) and possibly ordinary passenger cars (but not air-conditioned cars or power cars). There are local firms which have capability and experience in the fabrication of bridge girders. In the case of ordinary passenger cars, however, only KNR has previously manufactured some cars in its In Cheon shop. This shop is now used for repair and KNR does not intend to manufacture the cars. Since there are no Korean firms with previous experience in the manufacture of passenger cars, it was agreed during negotiations that the local bidders would be prequalified; procedures therefore would be established in consultation with the Bank. For the purpose of bid evaluation, domestic preferred bidders (where the value added in Korea would be not less than 20% of the exfactory bid price) would be accorded a preference margin of 15% of the c.i.f. bid price or the level of customs duties and other import taxes which a nonexempt importer would have to pay for the goods offered in the bid, whichever would be lower.

4.10 If Korean firms are permitted to bid and are successful, some local expenditure financing would be implied, since the local currency component of ordinary passenger cars constructed in Korea is estimated at 60%, a total of about US$7 million equivalent for 209 passenger cars. Total local currency component financing would, however, not exceed US$8 million equivalent. Disbursements would therefore be made as follows:

100% of the CIF cost of imported equipment and materials; and/or 100% of the ex-factory cost of locally manufactured equipment and materials.

Any savings under the loan would be used to finance additional but similar project items subject to review and agreement with the Bank.

4.11 The estimated quarterly rate of disbursement (Table 13) is based on the assumption that the Bank loan would become effective by December 1972.

D. Financing of the Project

4.12 Foreign exchange costs of the industrial lines electrification project would be covered by the assistance of a consortium of European manufacturers (Belgium, France, Germany and Switzerland). A special Yen credit of 27.24 billion Yen (US$88.4 million equivalent) has been given by Japan to Korea for the Seoul metropolitan area Rapid Transit Project (Annex 8); of this about US$50 million equivalent is relent by Government to KNR to cover the foreign exchange costs of the Seoul Suburban Electrification Scheme (including provision of electric cars) and some local cost financing. (The Government loan to KNR bears interest at 5% per annum and is to be repaid in 20 years including five years of grace.) KNR is negotiating with Kreditanstalt Fur Wiederaufbau (KFW), a loan to cover the foreign exchange cost for providing CTC in the Seoul area (about US$5.43 million equivalent). The following summary indicates the financing of the proposed project:

	US$ Million		
	Local	Foreign	Total
IBRD/IDA - Credit 183-KO/Loan 669-KO	8.92	15.17	24.09
IBRD - Proposed Loan	-	40.00	40.00
Consortium of European manufacturers	-	48.42	48.42
Yen Credit	15.00	35.07	50.07
German Loan (KFW)	-	5.43	5.43
KNR	14.90	-	14.90
Government	69.41	12.44	81.85
	108.23	156.53	264.76

5. ECONOMIC EVALUATION

A. The Economic Role of KNR

5.01 The growth of transport requirements and the present evolution from a virtual single mode (railroad) to a multiple transport system has resulted in the dominant role of KNR being diminished. The planned developments in the highways, coastal shipping and port capacities during the third Five-Year Plan will have their impact on the role of KNR in the Korean economy and KNR will face increasing competition. Nevertheless, KNR will continue to perform an important economic role. The physical and economic features (para. 2.02)

of Korea assign an important role to KNR as a carrier of substantial quantities of bulk commodities (coal, cement, ore, fertilizer, etc.) for which the railway is particularly suited. With good traffic densities on many sections of the railway lines, and good operating performance, costs are generally low and, if KNR pays adequate attention to the quality of service, it could continue to carry substantial volumes of freight and passenger traffic. In these circumstances, it is in Korea's economic interests to optimize the benefits of the considerable investments already made in the railway.

5.02 The investments envisaged in the transport sector during the third Five-Year Plan period (1972-1976) and the typical comparative transport fares and tariffs are shown in Tables 14, 15 and 16. Considering the capacities of the various modes of transport and the traffic demand in the future, and given existing transport fares and tariffs, the proposed KNR Investment Plan would bring substantial economic benefits to the country. If the Investment Plan is not carried out, large tonnages of bulk commodities and some passengers would have to be diverted at higher prices and costs to road and coastal shipping; the problem of mass transport in Seoul City would become unmanageable; KNR's operating costs would also rise.

B. Economic Benefits

5.03 KNR's Investment Plan, part of the third Five-Year Plan of Korea (1972-1976), has three important components:

(a) Electrification of the industrial lines (Jung Ang, Tae Baeg and Yeong Dong lines - involving 348.6 km of single line track lines connecting Seoul to the northeast of Korea) and associated investments on these lines such as track and bridge renewals (covering about 25% of the project);

(b) Electrification of the Seoul suburban area of KNR and associated investments in electric railcars and facilities for their maintenance and repair and the provision of CTC (covering about 23% of the project) required in connection with the Rapid Transit Project for the Seoul metropolitan area;

(c) Other investments, which cover track renewals and bridge strengthening, track equipment, signalling and telecommunications, purchase of freight cars and passenger cars (mainly for replacement), improvement of workshops and sheds, and some yard and line facilities.

These major components are designed to ensure the efficient operation of KNR by increasing its capacity to handle the growing traffic, avoiding increases in its operating costs, and improving the quality of service and safety. Detailed economic return calculations are shown in Annex 9.

5.04 Electrification of the industrial lines and the associated investments are intended to create capacity to enable KNR to carry the already very heavy and growing traffic between Seoul and the northeastern part of Korea

(where coal, iron ore and cement industries are located). This scheme was begun during the second Five-Year Plan period and was also included in the Third Railway Project. It was expected to be completed in 1973 and the economic rate of return assessed at 20%. The electrification of the lines is now expected to be brought into operation in stages and completed by 1974. The economic benefits will be in the form of savings in transportation costs by avoiding diversions of the bulk traffic to road and coastal shipping transport at higher cost; there will also be savings in operating costs due to the use of electric traction. Based on a life of 25 years for the equipment and facilities, the economic benefits would yield an economic return of about 20%.

5.05 The electrification of the Seoul suburban lines of KNR and the associated investments are important elements of the Rapid Transit Project for the Seoul metropolitan area. The city of Seoul has at present a population of 5.5 million and has been growing fast as a result of rapid growth in the Korean economy and the shift of population to the urban area. The present transport system consists mainly of bus and taxi service, and traffic congestion is already acute. The Rapid Transit Project aims at decentralizing the urban population into the suburban area and alleviating the present and growing traffic congestion in the city. The economic benefits will be in the form of savings in transportation costs by the substitution of rapid mass transit passenger trains for the presently used bus and taxi transportation. The economic rate of return is expected to be about 20%. Additional benefits would accrue from mitigation of air pollution, savings caused by reduction of traffic accidents, and savings in time for passengers. This suburban electrification will also accelerate the decentralization of population and community development along the lines and aid in improving land usage.

5.06 Of the other items of the Investment Plan (para. 5.03), freight cars now in the project include about US$19.8 million (over 7%), carried forward from the third project, the economic rate of return of which was assessed at 26%. Similarly, telecommunication facilities and track equipment, also carried forward, were assessed to have returns of 17% and 32%, respectively. It is, however, necessary to make an assessment of the group of these works, as the component works are interrelated for efficient train operation, quality of service and safety, particularly in the prevailing situation in KNR. Benefits attributable to an item would not fully materialize unless some of the other items of work are also carried out. For example, the replacement of some over-aged freight cars would obviate higher maintenance costs and deterioration in the quality of services, and thus avoid diversion of traffic; for this to be actually achieved, however, line and other facilities should be adequate. The economic benefits generated by this group of works, in the form of transportation cost savings in KNR's operating costs and avoidance of diversion of traffic to other modes at higher cost and price, indicate an economic rate of return of about 22%. Not included in these quantifiable benefits are savings in freight time, savings caused by reduced inventories of industries, reliability, and quality of service.

5.07 An assessment of the Investment Plan as a whole shows that the total economic benefits would yield an economic return of 20%. The Plan is fully justified.

6. FINANCIAL EVALUATION

A. Background

6.01 KNR had operating surpluses for several years. During the first three years of the second Five-Year Plan period (1967-1971), net operating revenues increased significantly, but the situation deteriorated in 1970, and KNR had a small operating deficit in 1971. KNR is not required to make a contribution to Government from its net revenues, but utilizes its net revenues for financing investments, replacements and debt servicing; it also receives assistance for investments from long-term foreign loans and short-term local finance, in addition to capital grants from Government.

B. Present position

6.02 The income accounts for the last five years are given in Table 17 and are summarized below:

	Won billion				
	1967	1968	1969	1970	1971
Operating revenue	19.91	27.41	31.71	33.05	31.24
Working expenses	14.55	17.50	20.26	23.79	27.94
Depreciation	2.54	3.68	3.56	3.94	3.91
Operating expenses	17.09	21.18	23.82	27.73	31.85
Net Operating revenue (loss)	2.82	6.23	7.89	5.32	(0.61)
Non-operating revenue (loss) Net	(0.09)	0.89	(1.72)	(0.57)	(0.65)
Interest charges	0.92	1.31	1.64	1.80	3.33
Net Income	1.81	5.81	4.53	2.99	(4.59)
Operating ratio %	85.8	77.3	75.1	83.9	101.9

The financial situation improved during 1967-1969 with increases in both traffic and in tariffs; these more than offset the cost increases. The situation started deteriorating in 1970 and sharply declined in 1971. The main causes were: (a) decrease in passenger traffic (other than commuters) during 1970 and 1971 (para. 3.13); (b) slow growth of freight traffic - partly due to KNR's inability to carry traffic because of the shortage of motive power and rolling stock, which eased only in the second half of 1971; and (c) increase in prices generally and increases in staff costs - 20% from April 1970 and 15% from 1971 - not compensated by freight tariff adjustments.

6.03 Interest and debt service coverage ratios varied between 2.7 and 5.4 and 1.7 and 4.9 respectively up to 1970; during 1971, debt service coverage was only about 0.3. During the 1967-1971 period, depreciation charges averaged about 12.5% of gross operating revenue. While the rates of depreciation provision are adequate, the actual provision in the last two years appears somewhat low, as there was apparently delay in transferring completed

"works in progress" to fixed assets. (With regard to track, roadbed, communications and power lines, no depreciation is charged; they are treated as "replacement" assets, the replacement cost of which is charged to operation; improvements are capitalized.)

6.04 The rate of return on average net fixed assets in use increased from 1.8% in 1967 to 4.4% in 1969 and, at the time of project appraisal in 1969 for Credit 183-KO/Loan 669-KO, the prospect for further improvement appeared good. However, for the reasons stated in paragraph 6.02, this proved to be too optimistic and the rate of return declined to 2.9% in 1970 and was negative in 1971. KNR therefore did not achieve the 7% rate of return from 1971, specified in Credit 183-KO. KNR did, however, control the staff strength and has reduced some staff. Recently KNR also deferred some maintenance expenditure, especially with regard to track, which is undesirable.

6.05 KNR's balance sheets as of December 31, 1969-1971 are shown in Table 18 and are summarized below:

	Won Billion		
	1969	1970	1971
Assets			
Current assets	10.7	17.5	23.3
Net fixed assets (including work in progress)	183.5	186.7	196.5
Other assets	5.8	7.0	34.7
Total assets	200.0	211.2	254.5
Liabilities			
Current liabilities	7.7	10.6	16.4
Debt	32.1	35.0	75.3
Equity (including retained earnings & capital surplus)	160.2	165.6	162.8
Total liabilities	200.0	211.2	254.5
Current ratio	1.4	1.7	1.4
Liquid ratio	0.6	1.0	0.7

6.06 KNR's first physical inventory and valuation of fixed assets was completed in 1965 and the book value of assets was adjusted in that year. The National Property Law requires the revaluation of National Controlled Real Property every five years. However, as required under a USAID loan of 1966, KNR carried out a further revaluation of its fixed assets as of December 31, 1966 which took into account the substantial devaluation of the Won in 1964 and the considerable increase in the value of land owned by KNR. The revaluation increased the gross value of fixed assets by Won 74 billion and capital surplus was increased correspondingly. KNR is currently undertaking a revaluation of its fixed assets, as of December 31, 1971.

6.07 The summary balance sheets show that the current ratio has been satisfactory during 1969-1971, but the liquid ratio was only 0.7 in 1971.

The debt/equity ratio increased to 32/68 in 1971. The debt as of December 31, 1971 includes IDA and Bank loans amounting to US$50.3 million, AID loans amounting to about US$25.7 million, Overseas Economic Cooperation Fund (Japan) loans of US$16.7 million and the utilization of the US$57 million loan extended by the consortium of European manufacturers for the electrification of the industrial lines. The devaluation of the Won increases the Won liability for loans payable in foreign currency. The devaluation losses are recorded by KNR as a deferred charge and are amortized over future years as the loan obligations are repaid.

C. Future Prospects

6.08 The deterioration in KNR's financial situation has already had adverse effects. Maintenance is tending to be reduced and some necessary investments get deferred, e.g., shortage of funds led to slower progress regarding provision of yard facilities and of ground facilities for electrification, thus resulting in a situation where electric locomotives are being received before the investments necessary to permit their use have been completed. Recognizing the need to improve KNR's financial position, the Government allowed KNR to revise the freight tariff and commuter passenger fares with effect from February 1972 (para. 3.26). These increases would enable KNR to have an operating surplus in 1972, but are insufficient to improve KNR's situation adequately, as there are cost increases; staff wages, for instance, were increased by 15% from April 1972 and there is an increase in general price levels. KNR intends to keep down staff strength and is planning some further reductions in staff in conjunction with the modernization and improvements included in the Investment Plan. Measures to improve revenue, particularly tariff adjustments, are needed, however, for adequate improvement of finances.

6.09 The forecast income accounts based on the projected traffic growth (paras. 3.12 and 3.16), increases in staff wages of 10% per annum in 1974 and 1976 with no increases during 1973 and 1975, increases in price levels of 3% per annum (following the stabilization measures now being taken by Korea), and tariff increases to improve KNR finances are given in Table 17, which also shows separately the additional revenues to be raised (over and above the revenue expected at 1972 fares and rates). The principal assumptions on which the financial forecasts are made are outlined in Annex 10. The forecast income accounts are summarized below:

	1972	1973	1974	1975	1976
Operating revenue	35.87	38.06	42.19	48.95	55.22
Working expenses	30.65	32.40	34.80	36.57	39.83
Depreciation	4.25	4.80	5.75	6.10	6.25
Operating expenses	34.90	37.20	40.55	42.67	46.08
Net operating revenue	0.97	0.86	1.64	6.28	9.14
Non operating revenue (loss) net	0.07	0.30	0.30	0.30	0.30
Interest charges	5.02	6.51	7.19	7.57	7.42
Net income (loss)	(3.98)	(4.35)	(5.25)	(0.99)	2.02
Operating ratio %	97.3	97.7	96.1	87.2	83.4

6.10 The question of financial targets for KNR and tariff adjustments needed to improve its finances were discussed with KNR and Government during negotiations. It was agreed that the objective should be for KNR to generate funds adequate to fully cover its operating expenditure and debt service obligations and finance a reasonable part of the investment needs, including replacements. Keeping in view KNR's situation in regard to investment needs and debt etc., it was agreed that KNR should aim at progressively improving its position and achieve a rate of return of at least 2% on its net fixed assets in use by 1975, 3% by 1976 and 5% by 1978. These are considered realistic targets in the present circumstances and KNR and Government indicated that a determined effort will be made to achieve them. Apart from cost reduction measures, including staff adjustment and implementation of the investment plan, tariff adjustments would be needed to achieve the targets. The Government indicated that in view of the prevailing economic situation and following the emergency measures taken recently (when public utility charges have not been allowed to increase) rail tariff increases cannot be immediately implemented. Rail freight tariffs would be increased, on a selective basis, by an average of 20% with effect from a date not later than January 1, 1974. However, if any relaxation in the economic measures undertaken recently were to be made and as a result thereof increases in public utility charges in Korea become feasible, the increases in rail tariffs would be given priority and Government would endeavor to effect the increase referred to as soon as possible during 1973. Further tariff adjustments would also be made in 1975 and 1976 - passenger and freight tariffs will be increased from January 1975 by such a level as to generate additional revenues equal to 20% of passenger revenues, and a further freight tariff increase, on a selective basis, of an average of 20% made from January 1976. The forecasts indicated in para. 6.09 above incorporate the results of these tariff adjusements. These tariff increases may appear somewhat large but it must be kept in view that rail freight tariffs have been very low; KNR handles large volumes of bulk commodities particularly suited to rail transport and, provided KNR pays attention to the quality of its service, it should be able to give effect to the tariff increases without losing traffic which would be economically justified for it to carry. Success of these measures, especially the tariff increases in the later years, would depend upon the strength of commercial action and service improvements that KNR would provide.

6.11 If there is a change in the level of staff wage increases and general price increases referred to in para. 6.09 above, or there are other events affecting KNR, the tariff adjustments indicated in para. 6.10 above may be inadequate to achieve the financial targets referred to. In order that appropriate remedial action is taken in time, when necessary, KNR and the Government will review KNR's financial situation in October of each year and furnish the results of such review to the Bank. If such a review indicates the need for additional tariff increases or cost reduction action, KNR and Government will consult the Bank and take measures satisfactory to the Bank.

6.12 The question of fares when KNR starts operating the electrified train services in conjunction with Seoul City, which will be in charge of

the subway, was discussed with KNR and Government and it was agreed that KNR would be protected from losses as a result of operation of the services.

6.13 The forecast shows that the times interest ratio would increase from 0.2 in 1973 to 0.9 in 1975 and 1.3 in 1976. Debt service coverage would increase from 0.4 in 1972 to about 1 in 1975 and 1.2 in 1976. Government assistance toward debt servicing would be required in 1972-1974 besides assistance for the investment program. Government agreed during negotiations, to provide the funds and facilities required (including funds required by KNR for servicing its debts) until completion of the project.

6.14 In order that KNR maintains a reasonable relationship between net cash revenue and debt service requirements, the question of debt limitation was discussed during negotiations. It was agreed that except for the Government loans to KNR in 1972 and 1973 (which had already been determined and also indicated to the Bank) Bank's agreement would be obtained before incurring any debt if the net cash revenue of KNR for the fiscal year or the 12 consecutive months immediately before the date of incurrence, whichever is greater, would be less than 1.2 times the maximum debt service requirement of any succeeding fiscal year on all debt of KNR, including the debt to be incurred.

6.15 The forecast balance sheet data are in Table 18 and cash flow data in Table 19. The current and the liquid ratios would progressively improve during 1972-1976 and vary from 1.5 to 2.2 and 0.9 to 1.3 respectively. The debt/equity ratio would reach a peak of 40/60 in 1974 and go down to 38/62 in 1976.

7. AGREEMENTS REACHED AND RECOMMENDATIONS

7.01 During negotiations, agreement was reached with the Government and KNR on the following principal items:

(a) KNR's Investment Plan for the period 1972-1976; no substantial changes to be made in the Investment Plan except by agreement between KNR, Government and the Bank (para. 4.01).

(b) Government commitment regarding provision of funds and facilities required, including funds required by KNR for servicing its debts, until the completion of the project (para 6.13).

(c) Financial targets for KNR and tariff changes (para 6.10, 6.11 and 6.14).

(d) Specific measures for improving transport planning and coordination (para. 2.11).

7.02 The project provides a suitable basis for a Bank loan of US$40 million to the Government for a term of 25 years, including a grace period of about four years. The loan would be passed on to KNR on identical terms.

October 20, 1972

TABLE 1

KOREA

FOURTH RAILWAY PROJECT

Traffic Development 1962, 1965-1970

		Actual						
I.	DOMESTIC TRAFFIC BY MODE	1962	1965	1966	1967	1968	1969	1970
	1. Freight (million tons)							
	Railway	17.9	22.4	24.1	27.4	28.9	30.6	31.6
	Highway	16.9	24.0	24.5	28.6	46.1	56.6	61.8
	Coastal Shipping	2.0	2.7	2.7	4.2	5.6	8.1	10.5
	Total	36.8	49.1	51.3	60.2	80.6	95.3	103.9
	2. Freight (billion ton-km)							
	Railway	4.0	5.0	5.5	6.2	6.9	7.3	7.7
	Highway	0.4	0.5	0.6	0.7	1.1	1.3	1.4
	Coastal Shipping	0.2	0.3	0.7	1.0	1.4	2.1	4.2
	Total	4.6	5.8	6.8	7.9	9.4	10.7	13.3
	3. Passenger (million pass)							
	Railway	100.6	107.2	138.3	152.0	151.0	154.7	131.0
	Highway	667.1	1,195.5	1,511.6	1,674.8	2,018.9	2,418.6	2,743.8
	Coastal Shipping	4.4	5.5	5.9	6.7	6.5	6.1	5.9
	Air Transport	-	0.2	0.2	0.2	0.3	0.6	0.9
	Total	772.1	1,308.4	1,656.0	1,833.7	2,176.7	2,580.0	2,881.6
	4. Passenger (billion pass-km)							
	Railway	5.9	6.9	8.7	9.6	10.6	11.1	9.7
	Highway	5.5	8.0	11.5	11.7	13.9	16.7	20.0
	Coastal Shipping	0.2	0.2	0.2	0.2	0.2	0.3	0.3
	Air Transport	-	0.1	0.1	0.1	0.1	0.2	0.3
	Total	11.6	15.2	20.5	21.6	24.8	28.3	30.3
II.	OTHER TRAFFIC							
	1. Port (million-tons)							
	Exports	0.8	1.6	1.7	1.8	2.3	2.9	3.6
	Imports	3.7	5.2	6.8	9.7	13.5	17.1	18.7
	Coastal Shipping	3.1	4.6	4.6	8.3	11.2	16.2	21.0
	Total	7.6	11.4	13.1	19.8	27.0	36.2	43.3
	of which In Cheon (%)	17.3	12.2	14.7	14.8	15.2	15.1	8.1
	Pu San (%)	43.4	38.5	40.4	32.0	26.1	22.2	21.3
	2. Air							
	International Pass (000)							
	In	18	37	65	87	112	133	191
	Out	20	40	66	88	116	135	201
	Domestic pass (000)	48	207	192	215	312	627	909
	Total	86	284	323	390	540	895	1,301

Sources: Economic Statistics Yearbook 1971, the Bank of Korea; Statistics Yearbook of Transportation, 1970, MOT

October 1972

KOREA

FOURTH RAILWAY PROJECT

Inventory of Motive Power and Rolling Stock (Actual Units)

Units as of December 31, 1971

			Steam Locomotives	Diesel Locomotives		Diesel Railcars		Passenger Cars	Freight Cars	Heating Vans
				Mainline	Shunting	Powered	Trailers			
Total in Fleet			80	296	41	156	118	1,513	15,189	136
In Service 1/		Sub-total	56	259	38	105	104	1,271	13,518	109
		Percentage	70	87	93	67	88	84	89	80
Out of Service		Under Repair	5	22	2	32	7	167	486	13
		Awaiting Repair	19	15	1	19	7	75	1,185	14
		Sub-total	24	37	3	51	14	242	1,671	27
		Percentage	30	13	7	33	12	16	11	20
Condition		Good	-	138	28	40	118	1,069	11,169	103
		Fair	20	158	13	41	-	51	1,708	10
		Poor	60	-	-	75	-	393	2,312	23
Age	Steam	Less than 20 years	-							
		Between 21 to 40 years	80							
		Over 40 years	-							
	Diesel	Less than 10 years		215	28	156				
		Between 11 to 20 years		81	13	-				
		Between 21 to 30 years		-	-	-				
		Over 30 years		-	-	-				
	Rolling Stock	Less than 10 years					118	1,066	8,064	103
		Between 11 to 20 years					-	40	3,105	-
		Between 21 to 30 years					-	25	1,384	-
		Between 31 to 40 years					-	75 *	2,629	10
		Over 40 years					-	307 *	7	23
Carrying Capacity of Freight Cars		Up to 30 tons							3,588	
		40 tons							7,062	
		50 tons							4,515	
		70 tons							24	

NOTE: 1/ Total in fleet less under or awaiting repair on the average

* Second-hand American, Manchurian and old Korean Governmental passenger cars, totaling 382

Source: KNR and mission estimates

October 1972

TABLE 2

KOREA

FOURTH RAILWAY PROJECT

KNR Freight Traffic - 1964 - 1971 Actual

	1964			1965			1966			1967			1968			1969			1970			1971		
	T	TK	AD	T	TK	AD	T	TK	AD	T	TK	AD	T	TK	AD	T	TK	AD	T	TK	AD	T	TK	AD
Grain	1.2	289	240	1.1	295	268	1.2	318	265	1.3	338	260	1.6	406	254	1.4	384	280	1.3	402	309	1.4	403	289
Fertilizer	1.0	217	217	1.8	316	176	1.7	186	109	1.2	202	168	1.5	312	208	1.2	330	277	1.1	312	284	1.1	344	303
Cement	1.1	323	294	1.5	412	275	1.7	476	280	2.2	565	257	3.1	844	272	4.4	911	209	4.9	1,003	205	5.8	1,222	211
Coal	8.3	1,768	215	8.9	1,848	208	10.0	2,070	207	11.0	2,242	204	9.6	2,103	218	10.3	2,377	230	12.1	2,785	230	12.1	2,881	238
Oil	0.4	143	358	0.6	184	307	0.7	238	337	1.1	350	328	1.5	515	343	1.8	559	303	2.4	641	267	2.5	724	293
Ore	0.6	231	385	1.0	262	262	1.0	269	269	1.4	335	239	1.7	368	217	1.7	402	234	1.8	453	252	1.6	424	265
Others	4.2	936	223	3.9	1,110	285	3.8	1,198	315	5.6	1,464	261	5.8	1,576	272	5.6	1,601	285	4.9	1,526	311	4.6	1,292	281
1. Sub-Total Commercial	16.8	3,907	233	18.8	4,427	235	20.1	4,755	237	23.8	5,496	231	24.8	6,124	270	26.4	6,564	249	28.5	7,122	252	29.1	7,290	251
2. Military Freight	2.1	389	185	2.1	387	184	2.1	403	192	2.3	464	202	2.8	548	203	2.7	552	204	2.1	439	209	1.9	449	234
3. KNR Freight	1.4	226	161	1.4	229	164	1.7	292	172	1.3	218	160	1.3	193	148	1.5	212	142	1.0	148	148	0.9	102	114
TOTAL	20.3	4,522	223	22.3	5,043	226	23.9	5,450	228	27.4	6,178	225	28.9	6,865	238	30.6	7,328	239	31.6	7,709	244	31.9	7,841	245

TABLE 3

Note: T = Million ton

TK= Million ton-km

AD= Average distance in km

Source: The Korean National Railroad

October 1972

KOREA

FOURTH RAILWAY PROJECT

KNR Freight Traffic Forecast 1972-1976

	1972			1973			1974			1975			1976		
	T	TK	AD	T	TK	AD	T	TK	AD	T	TK	AD	T	TK	AD
Grain	1.26	364	290	1.42	427	300	1.51	454	300	1.57	470	300	1.60	480	300
Fertilizer	1.10	326	297	1.23	363	294	1.32	389	294	1.47	432	294	1.60	470	294
Cement	6.07	1,262	208	6.65	1,363	205	7.09	1,453	205	7.84	1,608	205	8.70	1,774	204
Coal	11.66	2,682	230	12.79	3,019	236	12.82	3,026	236	13.40	3,163	236	13.76	3,248	236
Oil	2.09	558	267	2.28	609	267	2.45	648	264	2.75	725	264	2.99	790	264
Ore	1.97	502	255	2.28	537	236	2.63	620	236	3.23	762	236	3.69	871	236
Others	3.93	1,200	305	4.10	1,250	305	4.26	1,300	305	4.26	1,300	305	4.26	1,300	305
1. Sub-total, commercial	28.08	6,894	246	30.75	7,621	248	32.08	7,890	246	34.52	8,460	245	36.60	8,933	244
2. Military freight	1.61	336	209	1.81	385	213	1.88	400	213	1.88	400	213	1.88	400	213
3. KNR freight	0.89	140	157	0.95	142	150	1.06	159	150	1.17	175	150	1.19	178	150
4. TOTAL	30.58	7,370	241	33.51	8,147	243	35.02	8,449	241	37.57	9,035	240	39.67	9,511	240

Note: T = Million ton
TK = Million ton-km
AD = Average distance in km

Sources: KNR and mission's estimates

October 1972

TABLE 4

KOREA

FOURTH RAILWAY PROJECT

Passenger Traffic 1964-1971 Actual; 1972-1976 Forecast

	NUMBER OF PASSENGERS (Millions)				PASSENGER KM (Millions)				AVERAGE DISTANCE (KM)			
	Commuter	Long Dist.	Military	Total	Commuter	Long Dist.	Military	Total	Commuter	Long Dist.	Military	Total
Actual												
1964	32.9	83.6	2.1	118.6	731	6,107	515	7,353	22.2	73.0	250.8	62.0
1965	32.2	73.1	1.9	107.2	725	5,672	520	6,917	22.5	77.6	269.0	64.5
1966	38.4	98.0	1.9	138.3	830	7,288	546	8,664	21.6	74.4	285.0	62.7
1967	41.6	108.4	1.9	151.9	883	8,150	543	9,576	21.2	75.2	288.9	63.6
1968	38.7	110.6	1.6	150.9	828	9,280	482	10,590	21.3	83.9	301.2	70.1
1969	37.9	114.8	2.0	154.7	799	9,680	598	11,077	20.0	84.0	304.0	71.0
1970	38.2	91.4	1.7	131.3	854	8,425	539	9,818	22.4	92.2	299.4	74.8
1971	41.4	85.2	1.6	128.2	940	7,300	510	8,750	22.7	85.7	320.0	68.3
Forecast												
1972	42.0	95.4	1.7	139.1	953	8,590	510	10,053	22.7	90.0	300.0	71.7
1973	42.5	97.9	1.7	142.1	965	8,815	510	10,290	22.7	90.0	300.0	71.7
1974	75.0	97.6	1.7	174.3	1,206	8,784	510	10,500	16.0	90.0	300.0	59.3
1975	110.0	99.8	1.7	211.5	1,407	8,984	510	10,901	12.8	90.0	300.0	50.3
1976	150.0	101.0	1.7	252.7	1,650	9,090	510	11,210	11.0	90.1	300.0	43.3

TABLE 5

Source: KNR and mission estimates

October 1972

KOREA

FOURTH RAILWAY PROJECT

Summary of Operating Statistics (All Traffic)

	Second Five-Year Plan Period				
	1967	1968	1969	1970	1971
I. SYSTEM					
Route-km - Standard gauge (km)	2,980	3,036	3,073	3,073	3,085
- Narrow gauge (km)	125	125	125	125	125
- Total (km)	3,105	3,161	3,198	3,198	3,210
II. TRAFFIC					
Pass-km (millions)	9,577	10,590	11,077	9,819	8,750
Net ton-km (millions)	6,178	6,865	7,328	7,709	7,841
Traffic units (millions)	15,755	17,455	18,405	17,528	16,591
III. OPERATION					
Train-km by mode of traction					
- Steam (000's)	2,834	490	655	1,334	706
- Diesel (000's)	23,455	28,183	31,258	33,271	35,423
- Railcar-Powered (000's)	9,270	8,803	7,921	5,770	5,833
- Total (000's)	35,559	37,476	39,834	40,375	41,962
Train-km by service					
- Passenger (000's)	20,041	21,740	23,426	23,183	24,084
- Freight (000's)	15,518	15,736	16,408	17,192	17,878
- Total (000's)	35,559	37,476	39,834	40,375	41,962
Engine-km					
- Steam (000's)	6,836	3,424	3,744	4,659	4,516
- Diesel (000's)	29,742	35,539	38,878	40,698	43,122
- Railcar-Powered (000's)	17,894	16,691	14,587	11,900	12,286
- Total (000's)	54,472	55,654	57,209	57,257	59,924
Number of engines in fleet					
- Steam	205	115	115	109	80
- Diesel	238	252	282	277	337
- Railcar-Powered	163	161	161	156	156
- Total	606	528	558	542	573
Availability 1/ of engines					
- Steam (%)	-	-	-	66	70
- Diesel (%)	86	86	86	86	88
- Railcar-Powered (%)	69	70	65	67	67
Number of engines available					
- Steam	-	-	-	72	56
- Diesel (%)	205	217	243	238	297
- Railcar-Powered	112	113	105	105	105
Engine-km/engine-day available					
- Steam (km)	-	-	-	177	221
- Diesel (km)	397	449	438	468	429 2/
- Railcar-Powered (km)	438	405	381	311	321
Traffic unit/engine unit in fleet (millions)	31.5	33.2	33.0	32.3	31.3 2/

NOTE: 1/ 100% less percentage under or awaiting repair daily to average total in fleet
2/ Adjusted by assuming 50 new diesel locomotives delivered in the middle of 1971 were used for a full year

KOREA

FOURTH RAILWAY PROJECT

Summary of Operating Statistics (All Traffic)

	Second Five-Year Plan Period				
	1967	1968	1969	1970	1971
III. OPERATION					
Number of railcar-trailers and passenger cars in fleet					
- Railcar-Trailers	118	118	118	118	118
- Passenger cars	1,245	1,413	1,544	1,563	1,513
Availability of railcar-trailers and passenger cars					
- Railcar-Trailers (%)	88	88	88	88	88
- Passenger cars (%)	81	82	81	85	84
Number of railcar-trailers and passenger cars available					
- Railcar-Trailer	104	104	104	104	104
- Passenger cars	1,008	1,159	1,251	1,329	1,271
Passenger-vehicle 3/ -km (millions)	167.4	170.8	179.5	183.1	178.4
Passenger-vehicle-km/vehicle-day available (km)	375	340	337	326	330
Pass-km/train-km	479	488	473	423	363
Pass-km/pass-vehicle available (mil)	7.8	7.7	7.6	6.4	5.9
Pass-km/pass-vehicle-km	57	62	62	54	49
Number of freight cars in fleet	12,617	13,239	13,994	14,407	15,189
Availability of freight cars (%)	89	88	88	88	89
Number of freight cars available	11,229	11,650	12,315	12,678	13,518
Freight-car-km (millions)	300.6	320.1	328.3	325.9	332.4
Freight-car-km/car-day available (km)	73	75	73	70	67
Net ton-km/train-km	398	436	447	448	439
Net ton-km/freight car available (000's)	550	589	595	608	580
Number of freight cars loaded (000's)	821	803	865	846	847
Average turn-around 4/ of freight cars (days)	5.0	5.3	5.2	5.5	5.8
Average load of freight cars loaded (tons)	33.4	35.9	35.4	37.4	37.8
IV. STAFF					
Number of employees 5/	33,413	35,192	35,684	34,787	34,894
Traffic unit/employee (000's)	472	496	516	504	475

NOTE: 3/ Including railcars-powered, railcars-trailers and passenger cars
4/ Number of freight cars available divided by number of freight cars loaded daily
5/ Governmental employees only

mil = millions

Source: KNR and mission estimates

October 1972

KOREA

FOURTH RAILWAY PROJECT

KNR Investment Plan 1972-1976

US$: Won 400
Unit: US$ in thousands, Won (W) in millions

Item	Total Expenditure for 1972-1976			1972			1973			1974			1975			1976		
	Local W	Foreign US$	Total W	Local W	Foreign US$	Total W	Local W	Foreign US$	Total W	Local W	Foreign US$	Total W	Local W	Foreign US$	Total W	Local W	Foreign US$	Total W
1. New Line Construction																		
(a) Connection to Second In Cheon Port	254	324	384	-	-	-	254	324	384									
(b) Jeon Seon Line (8 km)	422	144	480	100	-	100	322	144	380									
(c) Industrial Sidings (10 km)	501	239	597	132	-	132	369	239	465									
Sub-total-items 1 (a+b+c)	1,177	707	1,461	232	-	232	945	707	1,229									
2. Electrification																		
(a) Industrial Lines Electrification (349 km)	4,373	13,820	9,901	1,336	8,935	4,910	1,159	1,598	1,798	1,478	3,287	2,793	400	-	400			
(b) Seoul Suburban Electrification (99 km)	9,448	16,656	16,111	3,000	16,364	9,546	6,448	292	6,565	-	-	-	-	-	-			
Sub-total-items 2 (a+b)	13,821	30,476	26,012	4,336	25,299	14,456	7,607	1,890	8,363	1,478	3,287	2,793	400	-	400			
3. Capacity Increase in Stations and Lines																		
(a) Seoul Area	1,940	50	2,140	320	-	320	1,002	163	1,067	618	338	753	-	-	-	-	-	-
(b) Marshalling Yard	2,598	832	2,931	100	-	100	1,217	122	1,266	380	-	380	596	81	628	305	629	557
(c) Signalling	4,645	6,724	7,335	130	2,424	1,100	2,101	3,485	3,495	1,703	437	1,878	515	248	614	196	130	248
(d) Double Tracking of Ho Nam Line (25 km)	1,140	450	1,320	540	450	720	500	-	500	100	-	100	-	-	-	-	-	-
(e) Station Building, Station Yard Extension and Bypass Lines	1,903	744	2,201	135	-	135	355	392	512	364	262	469	274	36	288	775	54	797
(f) Installation of Crossing Loop	655	230	748	-	-	-	148	54	170	433	149	493	74	27	85	-	-	-
(g) Lenghtening of Crossing Loop	1,103	478	1,294	40	-	40	216	82	249	180	90	216	432	216	518	235	90	271
Sub-total-items 3 (a+b+c+d+e+f+g)	13,984	9,959	17,969	1,265	2,874	2,415	5,539	4,298	7,259	3,778	1,276	4,289	1,891	608	2,133	1,511	903	1,873
4. Way and Structure																		
(a) Complete Track Renewal (400 km) and Rail Renewal (355 km)	7,178	13,792	12,694	513	3,510	1,917	1,745	3,111	2,989	1,640	2,390	2,596	1,640	2,391	2,596	1,640	2,390	2,596
(b) Equipment for Track Maintenance	166	3,898	1,725	35	1,498	634	131	2,400	1,091									
(c) Point and Crossing Improvement	536	442	713	117	97	156	211	175	281	208	170	276	-	-	-	-	-	-
(d) Bridge Strenghtening (4,628 m)	898	3,655	2,361	1	-	1	123	487	318	194	922	563	373	1,447	952	207	799	527
Sub-total-items 4 (a+b+c+d)	8,778	21,787	17,493	666	5,105	2,708	2,210	6,173	4,679	2,042	3,482	3,435	2,013	3,838	3,548	1,847	3,189	3,123
5. Motive Power and Rolling Stock																		
(a) Electric Locomotives (66 units)	-	34,600	13,840	-	12,110	4,844	-	10,223	4,089	-	12,267	4,907	-	-	-	-	-	-
(b) Electric Railcars (126 cars)	-	18,409	7,364	-	-	-	-	18,409	7,364	-	-	-	-	-	-	-	-	-
(c) Passenger Cars (395 cars)	1,466	20,723	9,756	-	-	-	-	12,615	5,046	-	5,500	2,200	733	1,304	1,255	733	1,304	1,255
(d) Freight Cars (4,264 cars)	7,742	22,554	16,764	2,807	9,391	6,563	537	1,432	1,110	950	2,534	1,964	1,235	3,294	2,553	2,213	5,903	4,574
(e) Heavy Breakdown Cranes (5 units)	-	1,370	548	-	-	-	-	1,370	548	-	-	-	-	-	-	-	-	-
(f) Other	680	880	1,032	100	-	100	113	-	113	241	880	593	113	-	113	113	-	113
Sub-total-items 5 (a+b+c+d+e+f)	9,888	98,536	49,304	2,907	21,501	11,507	650	44,049	18,270	1,191	21,181	9,664	2,081	4,598	3,921	3,059	7,207	5,942
6. Motive Power and Rolling Stock Repair Facilities																		
(a) Improvement to Existing Running Sheds	457	877	808	-	-	-	157	877	508	100	-	100	100	-	100	100	-	100
(b) Improvement to Existing Workshops																		
(i) Pu San and In Cheon	369	1,273	878	40	-	40	300	983	693	29	290	145	-	-	-	-	-	-
(ii) Seoul	287	921	655	50	-	50	-	-	-	237	921	605	-	-	-	-	-	-
(c) Freight Car Workshop at Dae Jeon	844	1,105	1,287	-	-	-	608	186	682	236	922	605	-	-	-	-	-	-
Sub-total-items 6 (a+b+c)	1,957	4,179	3,628	90	-	90	1,065	2,045	1,883	602	2,133	1,455	100	-	100	100	-	100
7. Miscellaneous																		
(a) Telecommunications	2,372	2,600	3,412	470	-	470	398	2,600	1,438	550	-	550	488	-	488	466	-	466
(b) Electric Power	975	-	975	30	-	30	55	-	55	70	-	70	410	-	410	410	-	410
(c) Containers	1,920	-	1,920	-	-	-	560	-	560	760	-	760	400	-	400	200	-	200
(d) Consultants Services, Training, etc.	182	257	284	-	91	36	-	166	66	55	-	55	46	-	46	81	-	81
Sub-total-items 7 (a+b+c+d)	5,449	2,857	6,591	500	91	535	1,013	2,766	2,119	1,435	-	1,435	1,344	-	1,344	1,157	-	1,157
8. Total	55,054	168,501	122,458	9,996	54,870	31,944	19,029	61,929	43,802	10,526	31,359	23,071	7,829	9,044	11,446	7,674	11,299	12,195
9. Contingencies	8,404	12,354	13,346	251	1,105	693	1,489	3,344	2,827	2,000	3,920	3,568	2,055	1,537	2,670	2,609	2,448	3,588
10. GRAND TOTAL	63,458	180,855	135,804	10,247	55,975	32,637	20,518	65,273	46,629	12,526	35,279	26,639	9,884	10,581	14,116	10,283	13,747	15,783

NOTE: Contingencies have been calculated on the basis of an increase of 6% p.a. in respect of local costs and 4% p.a. in respect of foreign costs, except where firm price contracts have been entered into, and in the case of Seoul suburban electrification scheme (including electric railcars) where provision for contingencies has already been included in the scheme.

TABLE 7

KOREA

FOURTH RAILWAY PROJECT

Calculation of Freight Car Requirements

Type of car	Number of cars in fleet for 1971 (A)	Number of serviceable cars for 1971 (B=Ax0.89)	Net ton-km for 1971 (C)(Mil)	Net ton-km per serviceable car for 1971 (D=C÷B)(000's)	Estimated net ton-km for 1976 (E)(Mil)	Number of service-able cars required for 1976 (F=E÷D)	Number of cars in fleet required for 1976 (G=F÷0.93)	Number of cars to be scrapped during 1972-1976 (H)	Number of cars required during 1972-1976 (I=G-A+H)	KNR-proposed freight car requirements (J)
Box Cars	5,333	4,746	1,539	324	1,709	5,275	5,672	1,000	1,339	1,350
Gondolas	5,611	4,994	3,624	726	4,263	5,872	6,314	1,100	1,803	1,850
Tank Cars	1,970	1,753	724	413	790	1,913	2,057	100	187	190
Flat Cars	1,131	1,007	341	339	470	1,386	1,490	70	429	440
Other 1/	1,144	1,018	1,613	158	2,279	1,442	1,551	-	407	434
Total	15,189	13,518	7,841	580	9,511	15,888	17,084	2,270	4,165	4,264

NOTE: 1/ Including brake vans

Mil = Millions

Sources: KNR and mission estimates

October 1972

TABLE 8

KOREA

FOURTH RAILWAY PROJECT

Calculation of Passenger Vehicle Requirements

Item	Type of traffic	Type of vehicle	Number of vehicles in fleet for 1971 (A)	Availability of vehicles for 1971 (B)	Number of serviceable vehicles for 1971 (C = A x B)	Pass-km for 1971 (D) (mil)	Pass-km per serviceable vehicle for 1971 (E=D÷C) (mil)	Estimated pass-km per serviceable vehicle for 1976 (F) (mil)	Estimated pass-km for 1976 (G) (mil)	Number of serviceable vehicles required for 1976 (H = G÷F)	Estimated or improved availability of vehicles for 1976 (I) (%)	Number of vehicles in fleet required for 1976 (J = H÷I)	Number of vehicles to be scrapped during 1972-1976 (K)	Number of vehicles required during 1972-1976 (L = J-A+K)	KNR-proposed vehicle requirement (M)
I.	Commuters:	Electric railcars 1/	-	-	-		-	10.0 2/	1,162	116	90	129	-	129	126
		DRC-Powered	79	67	53	940	9.0	9.0	488	27	85	33	-	- */	-
		DRC-Trailers	59	88	52					27	90	30	-	- */	-
		Sub-total	138	76	105	940	9.0	9.7	1,650	170	89	192	-	129	126
II.	Long Distance Passengers:	DRC-Powered	77	67	52	7,810	5.7	5.7	9,600	105	85	123	-	- */	-
		DRC-Trailers	59	88	52					79	90	88	-	- */	-
		Passenger cars	1,513	84	1,271					1,500	90	1,667	395	549	395
		Sub-total	1,649	83	1,375	7,810	5.7	5.7	9,600	1,684	90	1,878	395	549	395
III.	Total		1,787	83	1,480	8,750	5.9	6.1	11,250	1,854	90	2,070	395	678	521

TABLE 9

1/ Diesel railcar.
2/ To be designed exclusively for commuter traffic.
*/ Number of DRC in fleet, powered and trailers, remains unchanged during 1972-1976.

SOURCE: KNR and mission estimates.

mil = millions

October 1972

KOREA

FOURTH RAILWAY PROJECT

Composition of Motive Power and Rolling Stock as of December 31, 1971 with 1974 and 1976 Forecast

	Actual 1971	Forecast 1974	Forecast 1976	1976 over 1971 + or -
1. Motive Power				
Steam Locomotives	80	24 1/	24	
Diesel, Mainline Locomotives	296	296	296	0
Diesel, Shunting Locomotives	41	41	41	0
Diesel Railcars - Powered	156	156	156	0
Electric Locomotives	-	66	66	+ 66
Electric Railcars	-	126	126	+ 126
Sub-total(excluding steam)	493	685	685	+ 192
2. Passenger Car Stock				
Passenger Cars	1,513	1,513	1,513	0
Diesel Railcars - Trailers	118	118	118	0
Sub-total	1,631	1,631	1,631	0
Heating Vans	136	146	146	+ 10
3. Freight Car Stock				
Box Cars	5,333	5,548	5,683	+ 350
Gondolas	5,611	5,911	6,361	+ 750
Tank Cars	1,970	1,970	2,060	+ 90
Flat Cars	1,131	1,471	1,501	+ 370
Other	1,144	1,338	1,578	+ 434
Sub-total	15,189	16,238	17,183	+ 1,994

TABLE 10

NOTE: 1/ Steam locomotives are to be phased out by end-1974, except 17 locomotives for emergency use and 7 locomotives for narrow gauge lines.

Source: KNR and mission estimates

October 1972

US$: Won 400
Unit: US$ in thousands, Won (W) in millions

KOREA

FOURTH RAILWAY PROJECT

The Project 1972 - 1974

Total Expenditure for

ITEM	1972-1974 Local W	1972-1974 Foreign US$	1972-1974 Total W	1972 Local W	1972 Foreign US$	1972 Total W	1973 Local W	1973 Foreign US$	1973 Total W	1974 Local W	1974 Foreign US$	1974 Total W
1. New Line Construction												
(a) Connection to second In Cheon Port	254	324	384	-	-	-	254	324	384			
(b) Jeon Seon Line (8km)	422	144	480	100	-	100	322	144	380			
(c) Industrial Sidings (10 km)												
(i) Ul San Port Line (2.5 km)	141	45	159	20	-	20	121	45	139			
(ii) Ul San Petrochemical Sidings (7.8 km)	216	140	272	100	-	100	116	140	172			
(iii) Po Hang Steel Mill Siding (yard Only)	144	54	166	12	-	12	132	54	154			
Sub-Total, Items 1 (a+b+c)	1,177	707	1,461	232	-	232	945	707	1,229			
2. Electrification												
(a) Industrial Lines Electrification (349 km)												
(i) Jung Ang Line (155.2 km)	1,850	2,950	2,230	600	2,950	1,780	450	-	450			
(ii) Yeong Dong Line (85.5 km)	775	5,400	2,935	-	785	314	200	1,598	839	575	3,017	1,782
(iii) Tae Baeg Line (107.9 km)	805	5,200	2,885	36	5,200	2,116	200	-	200	569	-	569
(iv) Go Hang Line Construction (13.0 km)	1,343	270	1,451	700	-	700	309	-	309	334	270	442
Sub-Total, Item 2 (a)	3,973	13,820	9,501	1,336	8,935	4,910	1,159	1,598	1,798	1,478	3,287	2,793
(b) Seoul Suburban Electrification (99 km)												
(i) Kyeong In Line (38.9 km)	2,240	5,084	4,274	1,275	5,084	3,309	965	-	965			
(ii) Kyeong Pu Line (41.5 km)	1,840	3,624	3,290	1,125	3,624	2,575	715	-	715			
(iii) Kyeong Weon Line (18.2 km)	840	1,695	1,518	-	1,695	678	840	-	840			
(iv) Workshop and Running Shed for Electric Railcars and other	4,528	6,253	7,029	600	5,961	2,984	3,928	292	4,045			
Sub-Total, Item 2 (b)	9,448	16,656	16,111	3,000	16,364	9,546	6,448	292	6,565			
Sub-Total, Items 2 (a+b)	13,421	30,476	25,612	4,336	25,299	14,456	7,607	1,890	8,363	1,478	3,287	2,793
3. Capacity Increase in Stations and Lines												
(a) Seoul Area												
(i) Yong San Freight Center	471	163	536	200	-	200	271	163	336			
(ii) Seong Buk Freight Center	1,038	338	1,173	120	-	120	300	-	300	618	338	753
(iii) Double Tracking between Cheong Ryang Ri and Passenger Station	431	-	431	-	-	-	431	-	431			
Sub-Total, Item 3(a)	1,940	501	2,140	320	-	320	1,002	163	1,067	618	338	753
(b) Marshalling Yard												
(i) Dae Jeon	750	-	750	-	-	-	400	-	400	350	-	350
(ii) Je Cheon	221	-	221	-	-	-	221	-	221	-	-	-
(iii) Ul San	223	-	223	100	-	100	93	-	93	30	-	30
(iv) Bu Gok	333	122	382	-	-	-	333	122	382	-	-	-
(v) Kuk Su	170	-	170	-	-	-	170	-	170	-	-	-
Sub-Total, Item 3 (b)	1,697	122	1,746	100	-	100	1,217	122	1,266	380	-	380
(c) Signalling												
(i) Seoul CTC System	2,469	5,430	4,641	100	2,424	1,070	1,369	3,006	2,571	1,000	-	1,000
(ii) Automatic Block Signalling between Dae Jeon and Pu San	601	534	815	-	-	-	300	267	407	301	267	408
(iii) Automatic Train Stopping System	214	189	290	-	-	-	101	89	137	113	100	153
(iv) Tokenless Block System	218	193	295	-	-	-	139	123	188	79	70	107
(v) Level Crossing Improvement	432	-	432	30	-	30	192	-	192	210	-	210
Sub-Total, Item 3 (c)	3,934	6,346	6,473	130	2,424	1,100	2,101	3,485	3,495	1,703	437	1,878
(d) Double Tracking of Ho Nam Line (25 km)	1,140	450	1,320	540	450	720	500	-	500	100	-	100
(e) Station Building and Station Yard Extension												
(i) Station Building	278	-	278	100	-	100	-	-	-	178	-	178
(ii) Station Yard Extension at Jang Seong, Yeon Ju, Gim Cheon and Jo Chi Weon	576	654	838	35	-	35	355	392	512	186	262	291
Sub-Total, Item 3 (e)	854	654	1,116	135	-	135	355	392	512	364	262	469
(f) Installation of Crossing Loop												
(i) Jung Ang Line	248	81	281	-	-	-	-	-	-	248	81	281
(ii) Dong Hae Nam Bu Line	111	41	127	-	-	-	-	-	-	111	41	127
(iii) Jang Hang, Tae Baeg, and Kyeong Buk Lines	222	81	255	-	-	-	148	54	170	74	27	85
Sub-Total, Item 3 (f)	581	203	663	-	-	-	148	54	170	433	149	493
(g) Lengthening of Crossing Loop												
(i) Kyeong Pu Line	180	90	216	-	-	-	-	-	-	180	90	216
(ii) Kyeong Buk, Ho Nam, and Cheon Ra Lines	256	82	289	40	-	40	216	82	249	-	-	-
Sub-Total, Item 3 (g)	436	172	505	40	-	40	216	82	249	180	90	216
Sub-Total, Items 3 (a through g)	10,582	8,448	13,963	1,265	2,874	2,415	5,539	4,298	7,259	3,778	1,276	4,289
4. Way and Structure												
(a) Complete Track Renewal (200 km) and Rail Renewal (295 km)												
(i) Complete Track Renewal with Related Points and Crossings Renewal (200 km)	3,122	3,701	4,602	-	-	-	1,561	1,851	2,301	1,561	1,850	2,301
(ii) Rail Renewal (295 km)	776	5,310	2,900	513	3,510	1,917	184	1,260	688	79	540	295
Sub-Total, Item 4 (a)	3,898	9,011	7,502	513	3,510	1,917	1,745	3,111	2,989	1,640	2,390	2,596
(b) Equipment for Track Maintenance	166	3,898	1,725	35	1,498	634	131	2,400	1,091	-	-	-
(c) Point and Crossing Improvement												
(i) Kyeong Pu Line	344	283	458	117	97	156	115	94	153	112	92	149
(ii) Ho Nam, Jang Hang, and Cheong Ra Lines	192	159	255	-	-	-	96	81	128	96	78	127
Sub-Total, Item 4 (c)	536	442	713	117	97	156	211	175	281	208	170	276

	Total Expenditure for 1972-1974			1972			1973			1974		
	Local	Foreign	Total	Local	Foreign	Total	Local	Foreign	Total	Local	Foreign	Total
(d) Bridge Strengthening (1,516 m)												
(i) Industrial Electrification Lines (547 m)	116	452	297	-	-	-	-	-	-	116	452	297
(ii) Kyeong Pu Line (south of Su Weon, 868 m)	182	716	469	-	-	-	110	436	285	72	280	184
(iii) Seoul Suburban Electrification Lines (64 m) and Ho Nam Line (Dae Jeon-Iri, 37 m)	18	71	46	-	-	-	13	51	33	5	20	13
(iv) Bridge Girder Erection Equipment, etc.	2	170	70	1	-	1	-	-	-	1	170	69
Sub-Total, Item 4 (d)	318	1,409	882	1	-	1	123	487	318	194	922	563
Sub-Total, Items 4 (a through d)	4,918	14,760	10,822	666	5,105	2,708	2,210	6,173	4,679	2,042	3,482	3,435
5. Motive Power and Rolling Stock												
(a) Electric Locomotives (66 units)	-	34,600	13,840	-	12,110	4,844	-	10,223	4,089	-	12,267	4,907
(b) Electric Railcars (126 units)	-	18,409	7,364	-	-	-	-	18,409	7,364	-	-	-
(c) Passenger Cars (271 cars)												
(i) Air-conditioned Passenger Cars to operate with power generating cars (31 cars)	-	2,790	1,116	-	-	-	-	2,790	1,116	-	-	-
(ii) Power Generating Cars (9 cars)	-	1,260	504	-	-	-	-	1,260	504	-	-	-
(iii) Passenger Cars individually air-conditioned (22 cars)	-	2,420	968	-	-	-	-	2,420	968	-	-	-
(iv) Ordinary Passenger Cars (199 cars)	-	10,945	4,378	-	-	-	-	5,445	2,178	-	5,500	2,200
(v) Ordinary Sleeping Cars (10 cars)	-	700	280	-	-	-	-	700	280	-	-	-
Sub-Total, Item 5 (c)	-	18,115	7,246	-	-	-	-	12,615	5,046	-	5,500	2,200
(d) Freight Cars (2,449 cars)	4,294	13,357	9,637	2,807	9,391	6,563	537	1,432	1,110	950	2,534	1,964
(e) Heavy Breakdown Cranes (5 units)	-	1,370	548	-	-	-	-	1,370	548	-	-	-
(f) Other												
(i) Replacement of Diesel Locomotive Traction Motor (35 sets), Rebuilding of Diesel Railcars (13 cars), and Purchase of Engine and Convertor of Diesel Railcars (30 sets)	128	880	480	-	-	-	-	-	-	128	880	480
(ii) Replacement of Passenger Car Wheel Axle (280 axles) and Installation of Electric Generator in Passenger Car (190 sets)	326	-	326	100	-	100	113	-	113	113	-	113
Sub-Total, Item 5 (f)	454	880	806	100	-	100	113	-	113	241	880	593
Sub-Total, Items 5 (a through f)	4,748	86,731	39,441	2,907	21,501	11,507	650	44,049	18,270	1,191	21,181	9,664
6. Motive Power and Rolling Stock Repair Facilities												
(a) Improvement to Existing Running Sheds												
(i) Diesel Locomotive Sheds	157	390	313	-	-	-	57	390	213	100	-	100
(ii) Diesel Railcar Sheds and Passenger Car and Freight Car Sheds	100	487	295	-	-	-	100	487	295	-	-	-
Sub-Total, Item 6 (a)	257	877	608	-	-	-	157	877	508	100	-	100
(b) Improvement to Existing Workshops												
(i) Pu San	275	730	567	40	-	40	206	440	382	29	290	145
(ii) In Cheon	94	543	311	-	-	-	94	543	311	-	-	-
(iii) Seoul	287	921	655	50	-	50	-	-	-	237	921	605
Sub-Total, Item 6 (b)	656	2,194	1,533	90	-	90	300	983	693	266	1,211	750
(c) Freight Car Workshop at Dae Jeon	844	1,108	1,287	-	-	-	608	186	682	236	922	605
Sub-Total, Items 6 (a through c)	1,757	4,179	3,428	90	-	90	1,065	2,046	1,883	602	2,133	1,455
7. Miscellaneous												
(a) Telecommunications												
(i) Train Radio System and Dispatcher System	700	-	700	400	-	400	150	-	150	150	-	150
(ii) Microwave System and Exchange	718	2,600	1,758	70	-	70	248	2,600	1,288	400	-	400
Sub-Total, Item 7 (a)	1,418	2,600	2,458	470	-	470	398	2,600	1,438	550	-	550
(b) Electric Power	155	-	155	30	-	30	55	-	55	70	-	70
(c) Containers	1,320	-	1,320	-	-	-	560	-	560	760	-	760
(d) Consultants Services, Training, etc.	55	257	157	-	91	36	-	166	66	55	-	55
Sub-Total, Items 7 (a through d)	2,948	2,857	4,090	500	91	536	1,013	2,766	2,119	1,435	-	1,435
8. TOTAL	39,551	148,158	98,817	9,996	54,870	31,944	19,029	61,929	43,802	10,526	31,359	23,071
9. Contingencies	3,740	8,369	7,088	251	1,105	693	1,489	3,344	2,827	2,000	3,920	3,568
10. GRAND TOTAL	43,291	156,527	105,905	10,247	55,975	32,637	20,518	65,273	46,629	12,526	35,279	26,639

Note: Contingencies have been calculated on the basis of an increase of 6% p.a. with respect to local costs and 4% p.a. with respect to foreign costs, except where firm price contracts have been entered into, and in the case of Seoul suburban electrification shceme (including electric railcars) where provision for contingencies has already been included in the scheme.

October 1972

TABLE 12

KOREA

FOURTH RAILWAY PROJECT

Items Financed under the Loan

Item	Amount US$ million
1. Track materials and equipment	
- 50 kg/m rails (about 443 km)	7.96
- 37 kg/m rails (about 124 km)	1.68
- Materials for points and crossings	0.20
- Track maintenance and renewal equipment	2.40
Sub-total	12.24
2. Fabricated bridge girders and erection equipment	
- Fabricated bridge girders	1.24
- Erection equipment	0.17
Sub-total	1.41
3. 271 passenger cars	
- 31 air-conditioned passenger cars to operate with power generating cars	2.79
- 9 power generating cars	1.26
- 22 passenger cars individually air-conditioned	2.42
- 199 ordinary passenger cars	10.95
- 10 ordinary sleeping cars	0.70
Sub-total	18.12
4. 5 heavy breakdown cranes	1.37
5. Plant and machinery for workshops and running sheds	3.99
6. Contingencies	2.87
7. TOTAL	40.00

October 1972

TABLE 13

KOREA

FOURTH RAILWAY PROJECT

Estimated Schedule of Disbursements

IBRD Fiscal Year and Quarter	Cumulative Disbursement at end of Quarter US$ 000
1972/73	
March 31, 1973	1,860
June 30, 1973	1,860
1973/74	
September 30, 1973	5,870
December 31, 1973	18,740
March 31, 1974	20,890
June 30, 1974	25,820
1974/75	
September 30, 1974	34,150
December 31, 1974	36,030
March 31, 1975	39,350
June 30, 1975	39,630
1975/76	
September 30, 1975	39,760
December 31, 1975	39,880
March 31, 1976	40,000

Principal Assumptions:

1. Effective date of Loan: Not later than December 31, 1972

2. Bidding for procurement: Not later than November 1972 and January 1974 for rails;

   not later than November 1972 for passenger cars.

October 1972

KOREA

FOURTH RAILWAY PROJECT

Second and Third Five-Year Plan Transport Investments

Won Billion

	Third Five-Year Plan (1972-1976) 1/						Second Five-Year Plan (1967-1971) 2/		
	Central	Local	Private	Total	%	%	Total	%	%
Railways	105.6	-	-	105.6	9.8	26.3	85.8	11.8	39.2
Highways	165.1	62.0	-	227.1	21.1	56.5	98.7	13.7	45.1
Ports	54.7	-	2.9	57.6	5.4	14.3	30.2	4.2	13.8
Airports	11.2	-	-	11.2	1.0	2.7	4.0	0.6	1.8
Sub-total	336.6	62.0	2.9	401.5	37.3	100.0	218.7	30.3	100.0
Seoul Subway	-	72.3	-	72.3	6.7		-	-	-
Motor Vehicles and Airplanes	-	-	394.8	394.8	36.7		329.3	45.7	
Vessels	5.6	-	141.0	146.6	13.6		64.6	9.0	
Storage and Stevedoring	8.7	6.4	45.9	61.0	5.7		108.0	15.0	
Sub-total	14.3	78.7	581.7	674.7	62.7		501.9	69.7	
Total	350.9	140.7	584.6	1,076.1	100.0		720.6	100.0	

TABLE 14

N.B. The Third Five-Year Plan shown above is subject to changes, since the Government has started revising process as of May 1972

1/ Based on 1970 Prices

2/ Based on current prices for 1967-1969; budget figures for 1970; estimate figures for 1971

Source: The Economic Planning Board

October 1

KOREA

FOURTH RAILWAY PROJECT

Changes in Typical Rates and Fares Structure

Unit: Won; per person-km; ton-km

	1967	1968	1969	1970	1971	Remarks
Passenger Fares						
1. KNR	1.22	1.22	1.65	1.65	1.65	
2. Road	2.22	2.22	2.78	2.28	2.28	Intercity bus
3. Coastal shipping	1.78	1.78	1.78	2.13	2.13	Based on Pu San - Yoe Su (169 km) trip
4. Aviation	11.60	11.60	11.60	11.60	11.60	Domestic airline
Freight Rates						
1. KNR	1.60	1.60	1.61	1.61	1.61	3rd class, car load
2. Road	11.00	11.00	11.00	12.65	12.65	Regional freight (Seoul area)
3. Coastal shipping	0.69	0.69	0.69	0.82	0.82	Seoul - Pu San (709 km)
4. Aviation	150	150	150	150	150	Domestic airline

TABLE 15

Source: Ministry of Transport

October 1972

KOREA

FOURTH RAILWAY PROJECT

Comparative Typical Freight Rates for Major Commodities

(as of 1971)

Won per ton

Sections	KNR	Road	Coastal shipping
Coal:			
1. Hwang Ji - Pu San	681.70	6,175.25	1,469.97
2. Hwang Ji - Mug Ho	260.80	1,877.73	-
Cement:			
1. Sam Hwa - Kwang Ju	1,189.50	10,657.90	1,846.10
2. Sang Yong - Seoul	543.50	3,694.00	-
Fertilizer:			
1. Ul San - Dae Gu	365.90	2,859.27	-
2. Ul San - Song Jeong Ri	743.70	8,506.32	1,551.51
Grains:			
1. Pu San - Seoul	743.70	11,834.92	1,683.00
2. Jeong Jae Bu - Seoul	544.80	7,406.67	-
Oil:			
1. Ul San - In Cheon	1,219.00	11,156.30	832.91
2. Ul San - Seoul	1,097.70	10,410.72	-
Minerals:			
1. Jeong Ju - Seoul	552.00	3,389.48	-
2. Ye Mi - Pu San	750.90	9,161.68	-

Source: Ministry of Transportation

October 1972

TABLE 16

KOREA

FOURTH RAILWAY PROJECT

Revenue, Expenses and Net Income - Actual 1967-1971; Forecast 1972-1976
(Won Billion)

	ACTUAL					FORECAST				
	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
OPERATING REVENUE										
Passenger Revenue	10.68	15.49	18.12	19.39	17.30	20.32	20.81	21.24	22.19	23.02
Freight Revenue	7.38	9.74	11.11	11.15	11.59	13.15	14.75	15.29	16.35	17.22
Other Operating Revenue	1.85	2.18	2.48	2.51	2.35	2.40	2.50	2.60	2.70	2.80
Additional, Tariff Adjustments						-	-	3.06	7.71	12.18
Total Operating Revenue	19.91	27.41	31.71	33.05	31.24	35.87	38.06	42.19	48.95	55.22
OPERATING EXPENSES										
Operating Expenses Before Depreciation	14.55	17.50	20.26	23.79	27.94	30.65	32.40	34.80	36.57	39.83
Depreciation	2.54	3.68	3.56	3.94	3.91	4.25	4.80	5.75	6.10	6.25
Total Operating Expenses	17.09	21.18	23.82	27.73	31.85	34.90	37.20	40.55	42.67	46.08
Net Operating Revenue	2.82	6.23	7.89	5.32	(0.61)	0.97	0.86	1.64	6.28	9.14
Nonoperating Revenue/Loss (Net)	(0.09)	0.89	(1.72)	(0.53)	(0.65)	0.07	0.30	0.30	0.30	0.30
Net Revenue Before Interest	2.73	7.12	6.17	4.79	(1.26)	1.04	1.16	1.94	6.58	9.44
Interest Charges	0.92	1.31	1.64	1.80	3.33	5.02	6.51	7.19	7.57	7.42
Net Income (Loss)	1.81	5.81	4.53	2.99	(4.59)	(3.98)	(4.35)	(5.25)	(0.99)	2.02
RATIOS:										
Operating Ratio %	85.8	77.3	75.1	83.9	101.9	97.3	97.7	96.1	87.2	83.4
Times Interest Earned	3.1	5.4	3.8	2.7		0.20	0.17	0.27	0.87	1.27
Debt Coverage	4.1	4.9	3.4	1.7	0.3	0.44	0.50	0.60	0.96	1.23
Return on Average Net Fixed Assets in Use %	1.8	4.1	4.4	2.9	-	0.48	0.37	0.63	2.28	3.23

TABLE 17

Source: KNR and Mission Estimates

October 1972

KOREA

FOURTH RAILWAY PROJECT

Balance Sheet Data - Actual 1969 - 1971; Forecast 1972 - 1976
(Won Billion)

	ACTUAL			FORECAST				
	1969	1970	1971	1972	1973	1974	1975	1976
ASSETS								
Current Assets - Cash	0.47	0.22	0.45	0.55	0.60	0.60	0.60	0.60
- Inventory	6.48	6.79	11.28	8.60	7.70	7.15	7.10	7.00
- Other	3.73	10.46	11.56	11.37	10.20	9.26	9.26	9.26
- Total	10.68	17.47	23.29	20.52	18.50	17.01	16.96	16.86
Investments	1.10	1.94	2.20	2.30	2.30	2.30	2.40	2.50
Deferred Assets	4.37	4.97	11.81	11.90	11.90	11.90	11.90	11.90
Investment Assets Charged to Loan Account but not Received	0.36	0.10	20.70	11.30	6.57	0.35	0.10	0.10
Gross Fixed Assets	184.25	192.83	206.98	234.22	276.88	302.46	315.02	329.30
Less Accumulated Depreciation	9.72	13.31	16.97	20.75	24.95	30.40	36.30	42.35
Net Fixed Assets in Use	174.53	179.52	190.01	213.47	251.93	272.06	278.72	286.95
Works in Progress	8.92	7.17	6.46	8.40	8.00	6.00	5.00	4.00
TOTAL ASSETS	199.96	211.17	254.47	267.89	299.20	309.62	315.08	322.31
LIABILITIES								
Current Liabilities	7.65	10.56	16.44	13.84	10.31	8.71	8.39	7.74
Long-term Debt - Local	9.08	12.12	14.39	16.50	21.62	26.00	25.18	24.48
- Foreign	23.03	22.90	60.85	74.62	92.06	94.34	95.37	96.22
- Total	32.11	35.02	75.24	91.12	113.68	120.34	120.55	120.70
Equity - Fixed Capital	64.99	64.99	64.99	69.11	85.74	96.35	102.91	108.62
- Capital Surplus	77.13	79.55	81.12	81.12	81.12	81.12	81.12	81.12
- Earned Surplus	18.08	21.05	16.68	12.70	8.35	3.10	2.11	4.13
- Total Equity	160.20	165.59	162.79	162.93	175.21	180.57	186.14	193.87
TOTAL LIABILITIES	199.96	211.17	254.47	267.89	299.20	309.62	315.08	322.31
RATIOS: Current Assets/Current Liabilities	1.40	1.65	1.42	1.48	1.80	1.95	2.02	2.18
Current Assets Less Inventory/Current Liabilities	0.55	1.01	0.73	0.86	1.05	1.13	1.17	1.27
- Debt/Equity	17/83	17/83	32/68	36/64	39/61	40/60	39/61	38/62

Source: KNR and Mission Estimates

October 1972

TABLE 18

KOREA

FOURTH RAILWAY PROJECT

Cash Flow Forecast 1972 - 1976
(Won Billion)

	1972	1973	1974	1975	1976	Total 1972-1974	Total 1972-1976
FUNDS REQUIRED							
A. Investments -							
Local	10.25	20.52	12.53	9.88	10.28	43.30	63.46
Foreign	22.39	26.11	14.11	4.24	5.50	62.61	72.35
Sub-Total	32.64	46.63	26.64	14.12	15.78	105.91	135.81
Less Portion of Track Renewal) Charged to Operation)	1.72	2.29	1.95	1.95	1.95	5.96	9.86
Net Investment	30.92	44.34	24.69	12.17	13.83	99.95	125.95
B. Debt Service							
Interest	5.02	6.51	7.19	7.57	7.42	18.72	33.71
Repayment	6.94	5.40	5.59	5.62	5.34	17.93	28.89
Sub-Total	11.96	11.91	12.78	13.19	12.76	36.65	62.60
TOTAL FUNDS REQUIRED	42.88	56.25	37.47	25.36	26.59	136.60	188.55
FUNDS AVAILABLE							
A. Internally Generated -							
Net Operating Revenue	0.97	0.86	1.64	6.28	9.14	3.47	18.89
Depreciation	4.25	4.80	5.75	6.10	6.25	14.80	27.15
Sale of Assets, etc.	1.10	1.05	1.00	0.60	-	3.15	3.75
Sub-Total	6.32	6.71	8.39	12.98	15.39	21.42	49.79
B. Use of Existing Stocks of Rails, etc.	1.30	0.28	-	-	-	1.58	1.58
C. Loans							
IBRD - 183/669-KO	7.39	2.25	-	-	-	9.64	9.64
- Proposed Loan	-	7.50	6.92	1.58	-	14.42	16.00
Yen Credit Allocation	9.55	10.48	-	-	-	20.03	20.03
Consortium of European Manufacturers	8.42	4.73	6.22	-	-	19.37	19.37
Others	0.68	1.36	0.13	4.24	5.50	2.17	11.91
Sub-Total	26.04	26.32	13.27	5.82	5.50	65.63	76.65
D. Government	9.32	22.99	15.81	6.56	5.70	48.12	60.38
TOTAL FUNDS AVAILABLE	42.98	56.30	37.47	25.36	26.59		
Cash at Beginning of Year	0.45	0.55	0.60	0.60	0.60		
Cash at End of Year	0.55	0.60	0.60	0.60	0.60		

Source: KNR and Mission Estimates
October 1972

TABLE 19

KOREA

FOURTH RAILWAY PROJECT

Transport Infrastructure and Equipment

	1962	1965	1967	1969	1970
I. ROADS					
1. Road Network					
National Highways (km)					
Paved	865	1,042	1,442	1,957	2,451
Gravel	4,914	4,849	6,651	6,407	6,158
Unrepaired	31	8	93	206	40
Sub-Total	5,810	5,899	8,186	8,570	8,659
Local Roads (km)					
Paved	577	585	649	1,013	1,403
Gravel	18,219	17,874	21,860	23,954	26,803
Unrepaired	3,449	3,787	4,105	3,631	3,380
Sub-Total	22,245	22,246	26,614	28,598	31,586
Total (km)					
Paved	1,442	1,627	2,091	2,970	3,864
Gravel	23,133	22,723	28,511	30,361	32,961
Unrepaired	3,480	3,795	4,198	3,837	3,420
Grand Total	28,055	28,145	34,800	37,168	40,245
km/km^2/ (km)	0.29	0.29	0.35	0.38	0.41

Source: Ministry of Construction

2. Motor Vehicle Fleet					
Passenger Cars	11,074	13,001	23,235	50,299	60,677
Buses	4,406	9,313	11,499	14,327	15,831
Trucks	13,093	16,015	22,955	40,134	48,901
Others 1/	2,241	3,179	3,011	3,999	3,962
Total	30,814	41,508	60,700	108,759	129,371
persons/vehicle	1,038	771	527	294	47

1/ Includes motor cycles

Source: Ministry of Transportation

		1962	1965	1967	1969	1970
II.	VESSELS (Gross Tonnage)					
	Ocean-going: Passenger	-	915	915	915	915
	Cargo	-	156,844	258,337	463,440	491,143
	Oil Tanker	-	5,242	152,721	275,455	248,887
	Sub-Total	-	163,001	411,973	739,810	740,945
	Coastal: Passenger	-	14,886	15,168	17,227	17,742
	Cargo	-	42,498	66,859	85,358	96,073
	Oil Tanker	-	8,616	34,751	63,148	65,173
	Sub-Total	-	66,000	116,778	165,733	178,988
	Others		156,485	209,924	290,638	298,948
	TOTAL	373,099	385,486	738,675	1,196,180	1,218,881

Source: Ministry of Transportation

October 1972

KOREA

FOURTH RAILWAY PROJECT

Government Agencies Concerned with Transportation

I. Ministries

1. The Ministry of Transportation (MOT) is responsible for railroad and civil aviation infrastructure works. It controls transport operations for all modes, issues regulations, delivers licenses, performs cost calculations, sets rates and fares, collects transport statistics and undertakes research. It carries out its activities through four bureaus -- Land Transportation, Marine Transportation, Civil Aviation and Tourism -- and exerts control oover KNR.

2. The Ministry of Construction (MOC) is responsible, among others, for planning and construction of national highways and for planning, construction and maintenance of major ports. It controls the Korean Highway Corporation which is in charge of constructing, maintaining and operating toll roads, and Korea Dredging Corporation. It is also responsible for national and regional physical planning.

3. The Economic Planning Board (EPB) is responsible for the Five-Year Economic Development Plan, for the annual Overall Resources Budget, and for the national budget. Hence, it reviews and makes final decisions on all investments including transport investment programs. Other functions of EPB cover mobilization of the external resources and administration of price policy including transport fares and rates of all modes.

4. The Ministry of Agriculture and Forestry is responsible for farm and forestry roads.

5. The Ministry of Commerce and Industry (MOCI) is responsible for promoting and supervising assembly plants for motor vehicles, railway rolling stock and shipbuilding.

6. The Ministry of Finance (MOF) is responsible for establishing and collecting taxes related to transportation.

7. The Ministry of H ome Affairs (MOHA) is the highest authority over all local government. It is responsible for administration and execution of work on roads other than national highways and it administers various taxes, such as the vehicle and the acquisition tax, to help finance transport works by local authorities. MOHA is also in charge of the highway police.

II. New Bodies for Transport Coordination

1. The Transport Coordination Ministers Conference (TCMC) was established in January 1970 to coordinate and discuss transport plans and policies at the ministerial level. TCMC consists of the Ministers of EPB, MOC, MOHA, MOF, National Defense, MOCI, MOT and the Minister without Portfolio, and is headed by the Deputy Prime Minister and the Minister of EPB.

2. The Transport Coordination Working Group (TCWG) was established in September 1970 as an instrument of TCMC and is intended to provide liaison and information from the ministries concerned at the working level. This group also deals with monthly traffic allocation between rail and coastal shipping.

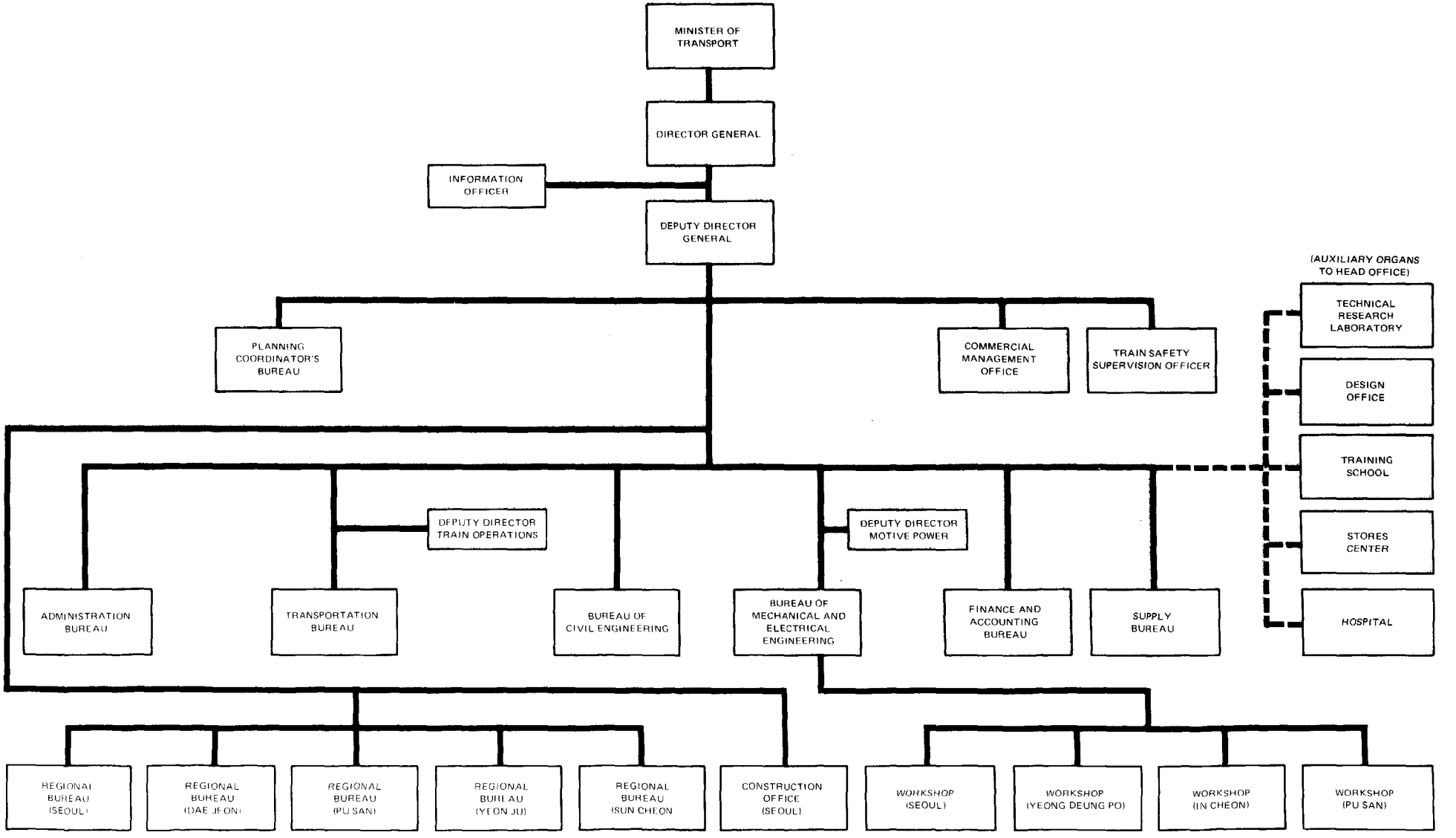
3. The Transport Planning Office (TPO) in MOT was organized in December 1969 for appropriate coordination of the transport sector and is designated as a permanent body to serve as secretariat of TCMC. MOC still retains authority over planning for highways and ports.

October 1972

ANNEX 3

KOREA

KOREAN NATIONAL RAILROAD ORGANIZATION



World Bank -6847

KOREA

FOURTH RAILWAY PROJECT

Description of Railway Property

1. Railway Lines

At the end of 1971, KNR operated 3,085 route-km of standard gauge (1,435 m) and 125 km of narrow gauge (0.915 m) lines, mainly single track; 528 km are double track, including the main line from Seoul to Pu San (445 km) and Seoul to In Cheon (39 km) (see Map). The narrow gauge line from Su Weon to Yeo Ju was closed in April 1972. The double track main lines have gradients not exceeding 1% and curves of 400 m minimum radius. There are many sections in mountainous areas; over 40% of the network has gradient over 1%; there are long sections of 2.5% and some of 3%. There are numerous curves, 134 km of tunnels and 97 km of bridges. Several of the bridges need strengthening, which is planned.

The total length of track, excluding about 1,381 km of sidings, is 4,156 km, of which 2,061 km is laid in 50 kg/m rails, 1,694 km in 37 kg/m rails and the rest in lighter rails; 27% of the main line tracks (excluding sidings) are under 10 years old and 11% more than 30 years. All renewal of principal lines is now with 50 kg/m rails. Some 66 km of track on the Seoul-Pu San line have welded rails and 80% of the track has hardwood ties; KNR, however, has used prestressed concrete ties, manufactured in Korea, on about 20% of the principal lines. Most of the track is laid with 22 cm of ballast but much ballast is round stone. Track is generally well maintained but KNR has been devoting more attention to rail renewals on a programmed basis; consequently, ballast and tie replacements have slowed down during the last two years.

The growth of traffic, especially on the double track main lines and the industrial lines to the northeast of Seoul which carry large volumes of heavy coal and cement traffic and are being electrified, and the use of heavier diesel/electric locomotives necessitate a change in the maintenance procedures adopted hitherto. KNR proposes to undertake complete renewal of about 400 km of track as well as 355 km of rail during the third Plan period. The track maintenance system will also be reorganized in 1972 with the receipt of track maintenance equipment, financed under Credit 183-KO/Loan 669-KO.

Signalling arrangements consist of color lights in the Seoul area and electric block instruments on most main lines. Centralized Traffic Control (CTC) has been installed on the single line of heaviest traffic between Mang U (near Seoul) and Bong Yang (148 km). Automatic block signalling has been installed between Seoul and Dae Jeon (167 km) on the Seoul-Pu San (Kyeong Pu) line, and extension to Pu San is planned. A CTC system for the Seoul area is planned with German bilateral aid. KNR has also introduced train radio equipment and the automatic train stopping system for safety and plans to extend their use.

Major anthracite coal mines are located in the northeastern part of Korea, where the major production of cement is also concentrated. The 350-km single track railway lines connecting this mountainous area with Seoul carry about 40% of KNR's freight traffic. Increasing traffic, especially coal and cement due to planned developments in this area, necessitates a substantial increase in line capacity. Electrification of 350 km of the three line sections involved ("Industrial Lines") was therefore included in KNR's second Five-Year Plan investments. Work commenced in 1970/71 and is now in progress. This electrification is now expected to be completed, in stages, by 1974.

2. Motive Power and Rolling Stock

KNR's motive power and rolling stock position at the end of 1971 is given in Table 2. The fleet consisted of 417 locomotives (80 steam, 337 diesel), 156 diesel railcars, 1,513 passenger cars, and 15,189 freight cars; this includes 50 diesel locomotives received by KNR in mid-1971 and financed under Credit 183-KO/Loan 669-KO. Only part of the freight cars financed under the credit/loan were received; the rest will be delivered in 1972 and 1973. Steam locomotives (except for 7 for narrow gauge lines and 17 reserved for emergency use) will be phased out by 1974. During the third Five-Year Plan period, KNR will receive 66 electric locomotives for operation on the electrified industrial lines.

About 400 of the 1,513 passenger cars are over-aged Manchurian Railways' or second-hand American Railways' cars and are in very poor condition. KNR plans to replace these cars during the third Five-Year Plan period.

About 17% of the freight cars are over 30 years old and many of them need replacement. About 24% of the freight cars have a carrying capacity of less than 30 tons. Shortage of freight cars has previously been a problem in rail transportation in Korea; this eased with the delivery of some freight cars financed under Credit 183-KO/Loan 669-KO.

3. Telecommunications

Much of KNR's telecommunications network has reached the end of its expected life, and modernization and development was included in KNR's planned investments. Consultants (Nippon Telecommunications Consulting Co.), whose studies are financed under Credit 183-KO/Loan 669-KO, have formulated detailed schemes, including installation of microwave and exchange equipment. These works are now expected to be executed in 1972/1973, with financing under Credit 183-KO/Loan 669-KO.

4. Marshalling Yards, Workshops and Other Property

Marshalling yard facilities are generally inadequate with relation to the expanding traffic and the need to increase consolidated train load operations. The requirements were reviewed by consultants (Touche Ross and Co.), who recommended increased yard capacity in several locations and construction of a new yard at Shi Heung with capacity to handle 1,500 cars. KNR could not acquire land at this site and, instead, increased the capacity

of some existing yards (Yong San, Seong Buk, Yeong Deung Po) and added a new yard at Bu Gok. KNR's proposals for the third Five-Year Plan period 1972-1976 covered an additional capacity of 900 cars per day in the Seoul area (300 at Bu Gok and 600 at In Cheon as part of a new In Cheon port line project), which meant a total capacity in the Seoul area somewhat below the level envisaged by consultants, but acceptable in view of the slower traffic growth than foreseen by them. KNR, however, later advised that the proposed In Cheon port line project will not now be taken up, but the work will be limited to a connection of the new port with the Shin Heung area of the existing KNR network with yard capacity for handling 120 cars daily. In view of this, the provision of substitute facilities for marshalling in the Seoul area was discussed during negotiations and the Investment Plan revised suitably by the addition of yard facilities at Su Saeg and KuK Su. An additional daily capacity of 350 freight cars by end 1974 and about 550 cars by end 1975 has thus been planned for the Seoul area. Marshalling yards other than those in the Seoul area are planned at Je Cheon (to handle an additional 740 cars a day), Dae Jeon (to handle 800 cars a day), and Ul San (to handle 300 cars a day).

KNR presently has four main workshops: Seoul (Yong San) for heavy maintenance of diesel rail cars, passenger coaches and freight cars; Yeong Deung Po for heavy repairs of steam locomotives, passenger coaches and freight cars; Pu San for heavy maintenance of diesel locomotives, passenger coaches and freight cars; and In Cheon, which until mid-1971 was engaged in construction and rebuilding of passenger coaches and freight cars. Nearly 60% of the workshop plant and equipment is over-aged and in need of replacement. With growing traffic and the addition of electric locomotives (due to industrial lines electrification) and of electric rail cars (due to Seoul suburban electrification), workshop repair facilities need improvement. Consultants (Touche Ross & Co.), who made a study financed under Credit 183/669-KO recommended the establishment of a new workshop at Dae Jeon with facilities for repair of passenger coaches and freight cars and centralized repair of diesel locomotives. In their report (1971), they envisaged the continuance of manufacturing activities at In Cheon shop. Since mid-1971, however, KNR has discontinued manufacture of rolling stock at the In Cheon shop and now intends to utilize this shop for repair of diesel rail cars and passenger cars.

KNR proposes to reorganize the Seoul (Yong San) workshop to handle repair of electric rail cars and electric locomotives. Pu San workshop is to continue repair of passenger cars, freight cars and all the diesel locomotives. The old Yeong Deung Po workshop situated in the Seoul area is proposed to be closed when steam traction is phased out by 1974; some of the equipment in good condition is to be transferred to running sheds. It is now planned to build a new workshop for freight car repair at Dae Jeon during the third Five-Year Plan period. The facilities at In Cheon, Pu San and Seoul are to be reorganized and improved with replacement of the over-aged plant and equipment. The details of facilities at Seoul for electric rail car repair are to be worked out by Japanese consultants employed in connection with Seoul suburban electrification. It was agreed during negotiations that these consultants would review the other facilities being planned by KNR in the reorganized Seoul workshop, from the point of view of overall coordination.

In addition to the four workshops, KNR has 18 running sheds for the light repair and inspection of steam and diesel locomotives, besides sheds and sick line repair facilities for passenger cars and freight cars. The question of concentration of locomotive repair shed facilities at fewer locations was discussed with KNR, especially with the phasing out of steam locomotives; KNR agreed to the facilities being concentrated at nine locations and the others being eliminated. Non-scheduled repairs to diesel locomotives now done at Pu San will be transferred to the running sheds. Over 50% of the plant and equipment at most of the running sheds is over-aged and needs replacement; this is now planned for the third Five-Year Plan period.

Maintenance procedures for diesel locomotives, diesel rail cars and freight cars were studied by consultants (Touche Ross and Co.); their recommendations have been generally accepted by KNR and are proposed to be implemented.

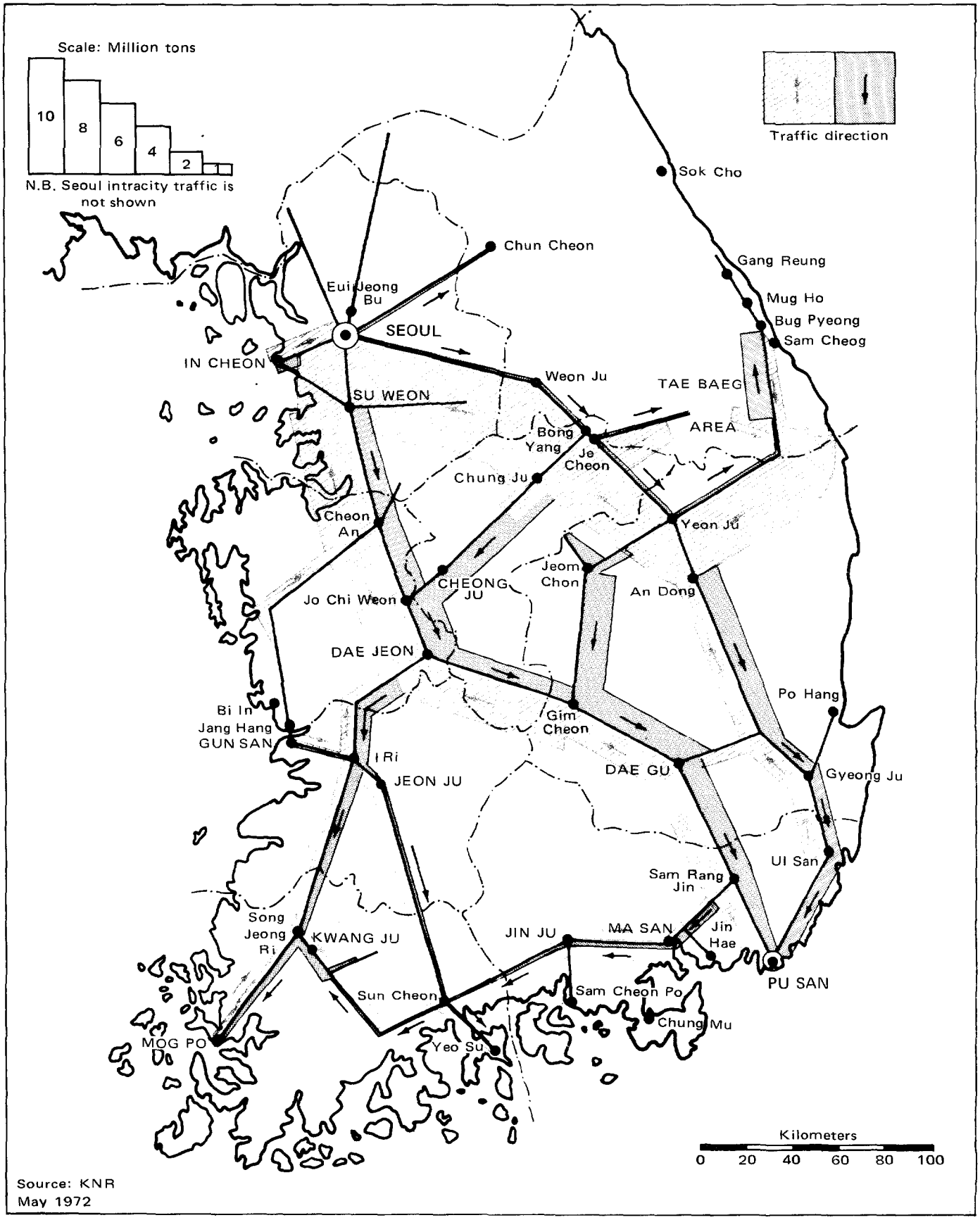
In general, the buildings, stations, offices and general plant of the railways are well maintained. However, some improvements are needed in certain stations and yards; these are now planned.

October 1972

KOREA
KOREAN NATIONAL RAILROAD

ANNEX 5

FREIGHT TRAFFIC DENSITY
(1970)



Source: KNR
May 1972

World Bank - 6846(R)

KOREA

FOURTH RAILWAY PROJECT

Tariff Structure

1. Freight Rates

The present tariff structure is relatively simple to apply and basically embodies the following practices:

(a) There are separate rate tables for carload shipments (accounting for over 90% of all freight), carload shipments in privately owned cars and less than carload shipments. Private car rates were 65% of KNR carload rates and this was raised to 75% of KNR carload rates in February 1972. Empty return of private cars is billed at 50% of the class four rate for the tare weight of the car.

(b) Each type of traffic is based on five tariff classes.

(c) Tariffs are entirely straight line in direct proportion to distance travelled, with the following exceptions:

(1) There is a 3,460 Won minimum charge (to help cover basic non-distance related costs; it also introduces a slight "de facto" distance taper into the rate structure).

(2) Carload charges are billed at a minimum carload weight which is usually equivalent to the practical capacity of the car for the particular commodity density.

(3) A small switching charge is made for every delivery or pickup, and for one or more cars to or from a customer's private siding.

(4) Demurrage is charged on cars after the first five hours of free time.

(d) Rates are quoted in increments for each block of 50 kilometers.

The main items in each class and the carload rates applicable from May 1969 up to January 1972 and from February 1972 are given below:

	Rate in Won per ton for each 50 km	
	May 1969	February 1972
Class 1 - Gasoline, cattle, textiles, clothing, furniture, meat and dangerous goods (which have a 10% extra charge)	121.30	133.0
Class 2 - Sugar, cotton, plywood, hardboard, tobacco	98.00	113.0
Class 3 - Cement, diesel and bunker oils, fruits and vegetables	80.75	97.0
Class 4 - Lumber, rice, grains, salt, fertilizer, limestone, ore, pulp, asphalt, bricks	66.30	83.0
Class 5 - Coal	57.65	73.00

The freight traffic structure provides little taper. A review of this and of commodity classification with reference to costs would be required to improve the tariff structure.

2. Passenger Fares

There were three classes of passenger fares prior to December 1969. Since the last few days of 1969, the distinction between classes of service has been abolished with the adoption of a single class of kilometrage rates, while revised surcharges have been retained for special services such as express trains, seat reservations and sleeper accommodation. In addition to these fares, there is a "transportation tax" of 10% reimbursable by KNR to Government. The minimum tariff is 30 Won. The normal passenger tariff is based on a charge of 1.65 Won per km excluding the tax and 1.815 Won including the tax. The surcharges (excluding tax) are as follows:

Express Surcharges - Minimum rate for distances up to 200 km; twice the minimum rate between 201 and 400 km; maximum rate for distances in excess of 401 km.

Tourist train (Kwang Gwang Ho)	200 - 800 Won
Special express (limited)	150 - 600 Won
Ordinary express	100 - 300 Won

Seat Reservations

Tourist train (Kwang Gwang Ho)	-	(Special car	1,500 Won
		(Normal car	1,000 Won
Limited express	-	(Special car	600 Won
		(Normal car	100 Won

Sleeper berths

Upper berth	-	700 Won
Lower berth	-	1,000 Won

Student and other commuters are given discounts for 1-month (60 trips) and 3-month (180 trips) tickets. These discounts have been reduced since February 1972. The fares in force prior to February 1972 and after this date are given below (including transportation tax):

	STUDENTS				OTHERS			
	1 month		3 months		1 months		3 months	
Dist. in km	Before Feb.'72	After Feb.'72	Before Feb.'72	After Feb.'72	Before Feb.'72	After Feb.'72	Before Feb.'72	After Feb.'72
1-20	420	800	880	2,400	1,210	1,370	-	4,110
21-25	450	1,020	990	3,060	1,460	1,750	-	5,250
26-30	480	1,240	1,100	3,720	1,600	2,130	-	6,390
31-35	520	1,460	1,180	4,380	1,760	2,540	-	7,620
36-40	560	1,680	1,230	5,040	1,880	2,880	-	8,640

October 1972

KOREA

FOURTH RAILWAY PROJECT

Investment Plan 1972-1976, Main Items

1. New Line Construction (1.1% of total expenditure)

In order to meet the growing freight traffic requirements in the In Cheon port, a railway connection between a new dock, now under construction, and the Shin Heung Area is planned and is expected to be completed in 1973. A short extension (8 km) of Jeong Seon Line in the Tae Baeg coal mine area, and the industrial sidings for Ul San and Po Hang industrial complexes are carried over from the second Plan and are expected to be completed in 1973.

2. Electrification (19.2% of total expenditure)

(a) Industrial Lines Electrification

In order to increase the traffic capacity on the single-track industrial lines (Jung Ang Line, 155.2 km; Tae Baeg Line, 107.9 km; and Yeong Dong Line, 85.5 km; total, 348.6 km), serving the coal mines and cement factories which are concentrated in the northeastern part of Korea, electrification started in 1970/71, and a major part of the work is carried out in this Plan period. The work includes ground facilities such as substations, overhead wire, modification of signalling and telecommunications equipment, and a 13-km railway connection including a 4.5-km tunnel, which will shorten the hauling distance between east and west by about 50 km. The electric traction is expected to commence in part by end 1972 and to be completed by end 1974.

(b) Seoul Suburban Area Electrification

This is part of the Seoul metropolitan rapid transit system aimed not only toward easing commuter traffic congestion in and around the Seoul area during rush hours but also toward helping accelerate the urban development in the Seoul-In Cheon-Su Weon triangle. While Seoul City constructs a 9.5-km subway between the Seoul central station and Cheong Ryang Ri, KNR electrifies the existing railway lines and links them with the subway. The work is expected to be completed by end 1973 or early 1974. Upon completion, six-railcar trains will operate through without change from KNR lines to the Seoul subway and vice-versa, with a minimum headway of five minutes. More details are given in Annex 8.

3. Capacity Increase in Stations and Lines (13.2% of total expenditure)

(a) Seoul Area

The construction of two freight centers at Yong San and Seong Buk to improve the freight handling facilities in the Seoul area was started under the second Plan and is expected to be completed in 1974.

(b) Marshalling Yards

In order to catch up with increased incoming and outgoing freight cars in and around the Seoul area, a marshalling yard at Bu Gok, 34 km south of Seoul, continues to be extended in the Plan period and is expected to be completed in 1973. Provision of yard facilities at Su Saeg and KuK Su to handle 455 freight cars daily is also now included in the Plan. Other than the Seoul area, two marshalling yards at Je Cheon, Ul San and Dae Jeon are expected to be completed over the Plan period.

(c) Signalling

This includes the Seoul CTC system, which was originally planned for smooth operation of long-distance passenger trains in the second Plan period and is now enlarged to cope with the frequent operations of electric railcar trains due to Seoul suburban area electrification. An extension of automatic block signalling on Kyeong Pu Line (Seoul-Pu San) beyond Dae Jeon to Pu San is now included in the Plan to improve the line capacity and also to ensure the safety of dense train movements. Both works are expected to be completed by end 1974. In addition, on the important lines, an enlargement of the automatic train stopping system, an extension of the tokenless block system, and level crossing improvements are included under this item over the Plan period in order to ensure safe train operations.

(d) Double Tracking of Ho Nam Line

An 89-km double tracking was originally planned and 25 km was completed at the end of the second Plan. Taking account of recent developments in the area, the completion of only another 25-km section, on which earthwork is already in process, is now envisaged; the balance is being deferred.

(e) Station Building, Station Yard Extension and Bypass Lines

This mainly covers provision of platform sheds for passengers and freight storage sheds at some important stations to provide better service. The station yard extension and bypass line construction are limited to some major junctions on the main lines.

(f) Installation of Crossing Loop

Emphasis is placed on sections such as the Jung Ang Line between Yeon Ju and Gyeong Ju and the Dong Hae Nam Bu Line between Po Hang and Pu San, in order that the capacity on these sections may be improved to handle the likely increase in bulk freight traffic.

(g) Lengthening of Crossing Loop

This is being planned at stations on the main lines to enable hauling of longer freight trains by the diesel locomotives recently received under Credit 183-KO/Loan 669-KO.

4. Way and Structure (12.9% of total expenditure)

(a) Complete Track Renewal and Rail Renewal

Of a total of 4,156 km of track length, about 1,600 km, consisting of the most important lines such as the Kyeong Pu Line, the Seoul suburban area lines, and industrial lines (the latter two sets of lines are to be electrified in the Plan period) require a change in the maintenance practice so far adopted by KNR. Accordingly, complete track renewal of 400-km track length is envisaged over the Plan period to replace old track with new welded 50 kg/m rails, prestressed concrete sleepers and crushed stone ballast. Rail renewal of 355 km, and some replenishment of ballast, is separately planned, generally covering the other main lines. Released rails from complete track renewal and rail renewal are stepped down to branch lines and sidings.

(b) Equipment for Track Maintenance

This includes track maintenance equipment, financed under Credit 183-KO/ Loan 669-KO and due to be delivered by mid 1972; one passenger-car-type track inspection car; and some track equipment, including not only portal cranes and heavy tampers, typical of track renewal on the double track section, but also hand-held tampers suited to track renewal on the single track section. The track equipment is expected to be delivered by end 1973.

(c) Point and Crossing Improvement

In order to shorten the travel time of passengers on the Kyeong Pu Line and some other important lines, point and crossing improvement is planned and is expected to be completed by end 1974.

(d) Bridge Strengthening

Of 15,732 m of bridge spans, 4,628 m is planned to be replaced over the Plan period to ensure the safety of train runs and to remove train speed restrictions in some cases. This work is planned to be carried out on certain bridges on the Kyeong Pu Line (Seoul-Pu San), the industrial lines, and the Seoul suburban (electrification) lines, which carry a great portion of the traffic of KNR, as well as on some other lines. Also included is bridge girder erection equipment.

5. Motive Power and Rolling Stock (36.3% of total expenditure)

(a) Electric Locomotives

These are to be used for the electrification of the industrial lines. Delivery will be completed by end 1974.

(b) Electric Railcars

These are to be used for the Seoul suburban area electrification and are expected to be delivered in 1973.

(c) Passenger Cars

These involve 271 passenger cars, which are required by end 1974, and another 124 passenger cars, which are required in 1975 and 1976. The former 271 passenger cars are broken down into 31 air-conditioned passenger cars to operate with power generating cars, 9 power generating cars, 22 passenger cars individually air-conditioned, 199 ordinary passenger cars, and 10 ordinary sleeping cars. These cars are scheduled to be put into service on Kyeong Pu Line and on some other important lines to improve the quality of railway passenger service.

(d) Freight Cars

These include 1,949 freight cars, financed under Credit 183-KO/ Loan 669-KO and expected to be delivered in 1972 and 1973, and another 2,315 freight cars, required in the years 1974, 1975 and 1976 and to be purchased locally.

(e) Heavy Breakdown Cranes

In order to restore the damaged section and reopen the line as quickly as possible in case of a train accident, a replacement of five inefficient steam-driven breakdown cranes is planned and expected to be delivered by end 1973.

(f) Other

In order to improve the availability of diesel locomotives and diesel railcars, a replacement of components is planned and expected to be completed by end 1974. Improvement to some passenger cars by installing electric generators to provide better service is also included.

6. Motive Power and Rolling Stock Repair Facilities (2.7% of total expenditure)

In order to reorganize motive power and rolling stock maintenance procedures and to increase work efficiency in accordance with the recommendations made by the consultants, improvement to existing running sheds and workshops is planned and expected to be completed mostly by end 1974. Also

included is a new freight car workshop at Dae Jeon, expected to be completed by end 1974. This shop would have capacity to attend to 3,500 freight cars annually.

7. Miscellaneous (4.8% of total expenditure)

This involves the installation of a microwave system between Seoul and Pu San and telephone exchanges, which is financed under Credit 183-KO/ Loan 669-KO and is expected to be completed in 1973. Also included are items such as a train radio system to ensure the safe train movement, dispatcher system to smooth train operation and freight car distribution, electric power facilities to provide passengers with better service, containers to meet shipper's needs, consultants' service, and training abroad of KNR staff.

October 1972

KOREA

FOURTH RAILWAY PROJECT

Seoul Suburban Electrification

1. Background

The rapid economic growth of Korea has brought about major changes in the industrial structure of the country and an urban shift of the population. The capital city of Seoul, around which a great deal of economic activity is concentrated, has grown rapidly (doubled in ten years) and has a present population of 5.5 million (more than one-sixth of the country's population). The population is expected to grow to about 7.5 million by 1981.

The present transport system consists mainly of bus and taxi transport, and 70% of the city's traffic is concentrated in the central business district, covering an area of 5.5 sq km. Congestion is already acute and immediate measures are needed to alleviate the worsening traffic situation.

The number of persons travelling to the central business district in one day exceeds one million, of which 0.6 million are commuters going to their place of work or school. This number is rising.

For the metropolitan area as a whole, a subcity center plan and a comprehensive land use plan have been worked out in an attempt to decentralize city functions; a promising residential district has been planned for the area south of the Han river. These areas need linking with the central business district.

A project has been drawn up by Japanese consultants who carried out a study of the problems involved. The objective of this project is to facilitate an amicable development of the metropolitan area as well as to eliminate traffic congestion, and to decentralize the urban population into the suburbs by the construction of a metropolitan rapid transit network within the Seoul metropolitan area.

2. Outline of the Project

The project provides for the construction in the city of Seoul of rapid transit subway, line No. 1, Seoul and Cheong Ryang Ri, and the electrification of the existing Korean National Railroad lines within the Seoul metropolitan area. The rapid transit subway, line No. 1, chosen as the first priority project of the planned five lines, will be connected to the Korean National Railroad at Seoul and Cheong Ryang Ri stations to provide through operation on these surface railroad lines to be electrified. The scope of work is as follows:

(1) Electrification of KNR lines

Kyeong Pu line (Seoul-Su Weon)	41.5 km
Kyeong In line (Seoul-In Cheon)	38.9 km
Kyeong Weon line (Yong San-Cheong Ryang Ri-Seong Buk)	18.2 km
Total	98.6 km

(2) Subway (Seoul Station-Cheong Ryang Ri station) 9.5 km

The gauge of track of the subway will be 1.435 mm (4 ft. 8-1/2"), conforming to that of KNR's surface system. The electric system for the subway will be of the DC type, (1,500 V) and, for the electrification of KNR, will be AC 25 KV 60HZ. Substation facilities on KNR will be provided at Yong San. Automatic block system by means of five aspect wayside signals, coupled with CTC system, is to be installed to ensure the safety and smooth running of trains. Telecommunication facilities to be provided include shielding all cables in the sections electrified and prevention of telecommunication line induction in adjacent wire. On the Kyeong Pu and Kyeong In lines, the stations will have ticket checking facilities on both sides; the existing stations, platforms and other passenger facilities will be improved. One hundred and twenty-six (126) electric railcars to be adapted for dual AC-DC operation will be acquired for KNR and 60 for the subway portion (to be owned by Seoul City). The electric railcars will be put into through operations from KNR lines to the Seoul subway and vice-versa, with a six-railcar train formation in a headway of five minutes on the section from Yeong Deung Po through the subway to Cheong Pyang Ri, and 10 to 15 minutes on the three KNR suburban lines during rush hours. A car shed for KNR's electric railcars is planned at Gu Ro. The heavy repair of electric railcars will be done at Seoul workshop of KNR, which is to be reorganized. Seoul City is planning separate facilities for electric car repairs and signal control in consideration of the expansion of the subway in the future.

The estimated costs of KNR electrification and the time-phasing of expenditure are shown on the following page:

	Total Cost		1972		1973	
	Local Million W.	Foreign US$ 000	Local Million W.	Foreign US$ 000	Local Million W.	Foreign US$ 000
Kyeong In line Seoul-In Cheon (38.9 km)	2,240	5,084	1,275	5,084	965	-
Kyeong Pu line Seoul-Su Weon (41.5 km)	1,840	3,624	1,125	3,624	715	-
Kyeong Weon line Yong San-Cheong Ryang Ri-Seong Buk (18.2 km)	840	1,695	-	1,695	840	-
Electric railcar and test operation (126 cars & spares)	-	18,409	-	-	-	18,409
Repair & maintenance facilities - Gu Ro electric car shed and Seoul car shop	4,528	6,253	600	5,961	3,928	292
Total	9,448	35,065	3,000	16,364	6,448	18,701

KNR is undertaking the construction work in regard to its electrification project and Seoul City is undertaking the work in regard to the subway. The two organizations have set up coordinating bodies. The Ministry of Transport and the Economic Planning Board also play an active role in the coordination and implementation of the whole project. A loan of Yen 27.24 billion (US$88.44 million equivalent) has been extended to the Government of Korea by the Overseas Economic Cooperation Fund (OECF), Japan. Of this, Yen 15.42 billion (US$50.07 million equivalent) has been allocated to KNR and the balance (Yen 11.82 billion or US$38.38 million equivalent) to Seoul City. The loan from Japan to the Government carries interest at 4.125% per annum, with repayment in 20 years, including five years of grace. Government has relent the proceeds of the loan to KNR and Seoul City at 5% per annum with repayment in 20 years, including five years of grace. The loan finances goods and services required for the project and obtained from Japan, except that Yen 9.24 billion (of which KNR's portion is Yen 4.62 billion, US$15.0 million equivalent) can be used for local currency financing under a prescribed procedure.

Consultants from Japan have been provided under the loan to assist in the implementation and completion of the project. The electrification of KNR suburban lines is expected to be completed by end December 1973 and electric train operation is expected from 1974.

October 1972

KOREA

FOURTH RAILWAY PROJECT

Economic Return Calculations

1. Electrification of the Industrial Lines

Table 1 of this Annex shows the calculations of a typical economic return on the above-mentioned component of the Plan. Economic benefits in the form of transport cost savings are generated by avoiding diversions of the bulk rail traffic (from northeast of the country to the Seoul-In Cheon area) to coastal shipping at higher cost, by shortening the hauling distance (some 50 km), and by replacing diesel traction with electric traction. The investment costs provide for (a) construction of ground facilities, (b) procurement of electric locomotives, and (c) associated investments including increases in line capacity, track renewals and a new signalling system. Within the analysis, the economic costs of various means of transport have been based on the financial costs. The major variables involved in calculating the economic benefits are (a) the economic costs of rail operation by both diesel and electric traction, (b) the economic cost of alternative transport by coastal shipping including transshipment costs, and (c) the volume and anticipated rate of growth of traffic on the relevant KNR lines and, consequently, the volumes of traffic which would have to be diverted from the railways because of present capacity limitations. The estimated economic return would, therefore, vary, depending upon alternative assumptions for major variables in the analysis. Assuming that the economic cost of the investment would be higher by 10% (taking into account the possible over-valued Won currency in terms of dollars), and, at the same time, the incremental transport cost of coastal shipping traffic diverted from KNR would be lower by 5%, the economic return would be about 17%. If, as is quite likely, traffic volumes materialize faster than estimated and operating costs of electric traction are lower than diesel traction, the economic return would be substantially higher than the 20% shown in Table 1 of this Annex. The particular economic return calculations in Table 1 do not include the possible benefits accruing to passenger traffic, e.g., time savings and increase in comfort. To this extent, the economic return is understated.

2. Seoul Suburban Electrification

Table 2 of this Annex shows the calculations of a typical economic return on electrification of the Seoul Suburban area of KNR. Economic benefits in the form of transport cost savings are generated by the substitution of rapid mass transit passenger trains for the presently used bus and taxi transportation. The investment costs cover (a) the construction of ground

facilities, (b) purchase of electric rail cars, and (c) associated investments such as repair and maintenance facilities required for item (b). Economic costs of operating suburban lines are based on the financial data provided by KNR; economic costs of operating buses and taxis are based on data provided by EPB. The major variables involved in quantifying economic benefits are economic costs of various means of passenger transport and the volumes of passenger traffic expected to divert to suburban railway services (given the pricing policies for various modes of transport). The estimated economic return would, therefore, vary, depending on alternative assumptions for major variables in the analysis. Assuming that the economic cost of the investment would be higher by 10%, and that the incremental transport cost saving would be lower by 5%, the economic return would be about 16%. If the diversion of passenger traffic from buses and taxis to suburban lines is larger than conservatively estimated, and if the incremental transport unit cost savings are higher, the economic return would be substantially higher than 20%, which is shown in Table 2 of this Annex.

3. Other Investment Items

Other investment items cover track renewals and bridge strengthening, track equipment, signalling and telecommunications, purchase of freight cars and passenger cars, improvement of workshop and sheds, and some yard and line facilities, all of which have not been included in the economic analysis for electrification of the industrial lines and of the Seoul Suburban lines. Table 3 of this Annex shows the calculation of a typical economic return on these items. Economic benefits in the form of transport cost savings are generated by improving KNR's operating efficiency, and increasing KNR's capacity, thereby avoiding diversion of traffic to other modes, particularly road transport, at higher cost. KNR's costs are based on operating expenditures, including depreciation, but excluding those operating expenditures associated with the industrial and the suburban lines. Transport costs of other modes, expressway buses and trucks, are based on EPB estimates. The freight and passenger traffic forecast in Tables 4 and 5 in the text of the report is based on the implementation of the investment program, excluding traffic generation related to the industrial and suburban electrification.

KOREA

FOURTH RAILWAY PROJECT

Economic Return Calculations for Electrification of the Industrial Lines

(*Unit*: W million; US$'000)

Year	CAPITAL COST (1)												TRANSPORT COSTS (2) Without Project			TRANSPORT COSTS (3) With Project	NET BENEFIT
	Construction Costs			Locomotives			Others			Total							
	Local	Foreign	Subtotal (A)	Local	Foreign	Subtotal (B)	Local	Foreign	Subtotal (C)	Local	Foreign	Total (A)+(B)+(C)	Rail (Diesel)	Other	Subtotal	Rail (Electric)	(2)-(3)-(1)
	(W)	($)	(W)	(W)	($)	(W)	(W)	($)	(W)	(W)	($)	(W)	(W)	(W)	(W)	(W)	(W)
1972	1,336	8,935	4,910	-	12,110	4,844	148	157	211	1,484	21,202	9,965	1,500	-	1,500	1,350	-9,815
1973	1,159	1,598	1,798	-	10,223	4,089	850	690	1,126	2,009	12,510	7,013	1,545	840	2,385	1,150	-5,778
1974	1,478	3,287	2,793	-	12,267	4,907	932	1,029	1,344	2,410	16,583	9,044	1,591	1,544	3,135	750	-6,659
1975	400	-	400	-	-	-	402	690	678	802	690	1,078	1,639	2,432	4,071	765	2,228
1976	400	-	400	-	-	-	402	699	678	80802	690	1,078	1,688	3,526	5,214	780	3,356
1977	-	-	-	-	-	-	-	-	-	-	-	-	1,772	3,956	5,728	796	4,932
1978	-	-	-	-	-	-	-	-	-	-	-	-	1,861	4,422	6,283	812	5,471
1979	-	-	-	-	-	-	-	-	-	-	-	-	1,954	4,925	6,879	828	6,051
1980	-	-	-	-	-	-	-	-	-	-	-	-	2,052	5,465	7,517	845	6,672
1981	-	-	-	-	-	-	-	-	-	-	-	-	2,155	6,049	8,204	861	7,343
1982-1998	-	-	-	-	-	-	-	-	-	-	-	-	2,262	6,679	8,941	878	8,063

Economic Return = 19.7%

October 1972

TABLE 1 TO ANNEX 9

KOREA

FOURTH RAILWAY PROJECT

Economic Return Calculation for Seoul Suburban Electrification

(Unit: W million; US$'000) 1/

Year	CAPITAL COST (1)											TRANSPORT COSTS (2) 2/ Without Project										OPERATING COST OF SUBURBAN LINES (3) With Project	NET BENEFITS (2)-(3)-(1)
	Construction Costs			Electric Cars		Others			Total			Expressway Buses			Intra-city Buses			Taxie			Subtotal		
	Local (W)	Foreign ($)	Subtotal (W)	Foreign ($)	Subtotal (W)	Local (W)	Foreign ($)	Subtotal (W)	Local (W)	Foreign ($)	Total (W)	Pass-km (mil)	x Unit Cost (Won)	=Costs (A)	Pass-km (mil)	x Unit cost (Won)	=Costs (B)	Pass-km (mil)	x Unit cost (Won)	=Costs (C)	(A)+(B)+(C)		
1972	2,400	9,703	6,281	-	-	690	7,183	3,563	3,090	16,886	9,844	-	-	-	-	-	-	-	-	-	-	-	-9,844
1973	2,520	-	2,520	17,209	6,884	3,322	1,763	4,027	5,842	18,972	13,431	-	-	-	-	-	-	-	-	-	-	-	-13,431
1974	-	-	-	-	-	1,199	341	1,335	1,199	341	1,335	80	3.30	264	130	4.62	601	20	43.20	864	1,729	412	-18
1975	-	-	-	-	-	300	341	436	300	341	436	80	3.30	264	295	5.08	1,500	30	47.52	1,426	3,190	587	2,167
1976	-	-	-	-	-	451	312	576	451	312	576	80	3.30	264	495	5.59	2,767	30	52.27	1,568	4,599	783	3,240
1977	-	-	-	-	-	-	-	-	-	-	-	80	3.60	288	595	6.15	3,649	30	57.50	1,725	5,672	937	4,735
1978	-	-	-	-	-	-	-	-	-	-	-	80	3.60	288	645	6.76	4,360	30	63.25	1,898	6,546	1,030	5,516
1979	-	-	-	-	-	-	-	-	-	-	-	80	3.60	288	695	7.44	5,171	30	69.57	2,087	7,546	1,130	6,416
1980	-	-	-	-	-	-	-	-	-	-	-	80	3.60	288	745	8.18	6,094	30	76.53	2,296	8,678	1,207	7,471
1981	-	-	-	-	-	-	-	-	-	-	-	80	3.60	288	795	9.00	7,155	30	84.18	2,525	9,968	1,290	8,678
1982-1999	-	-	-	-	-	-	-	-	-	-	-	80	3.60	288	845	9.90	8,366	30	92.60	2,778	11,432	1,370	10,062

Economic Return = 20.0%

Note: 1/ Other units are used as they are necessary; those are specified as described above.

2/ The unit transport costs for intra-city buses and taxis are assumed to grow 8% annually due to traffic congestion; 2% due to costs increase caused by aging.

October 1972

TABLE 2 TO ANNEX 9

KOREA

FOURTH RAILWAY PROJECT

Economic Return Calculations for Other Investment Items

(Unit: W million; US$'000) 1/

Year	CAPITAL COST (1) Local (W)	Foreign ($)	Subtotal (W)	TRANSPORT COST SAVINGS (2) KNR Operating Costs 2/ (A) (W)	Passenger Costs (B) (Pass-km) (mil) 3/	x (Unit cost) (Won) 4/	= Costs	Freight Costs (C) (Ton-km) (mil) 5/	x (Unit cost) (Won) 6/	= Costs	Subtotal (A)+(B)+(C) (W)	NET BENEFIT (2) - (1) (W)
1972	4,106	15,582	10,339	200	-	-	-	-	-	-	200	-10,139
1973	9,574	29,247	21,273	400	315	3.30	1,040	180	8.40	1,512	2,952	-18,321
1974	6,414	14,435	12,188	707	284	3.30	937	220	8.40	1,848	3,492	-8,696
1975	6,217	7,932	9,390	728	484	3.30	1,597	270	8.40	2,268	4,593	-4,797
1976	6,027	9,594	9,865	750	590	3.30	1,947	340	8.40	2,856	5,553	-4,312
1977	-	-	-	772	650	3.60	2,340	680	8.80	5,984	9,096	9,096
1978	-	-	-	796	750	3.60	2,700	1,038	8.80	9,134	12,630	12,630
1979	-	-	-	820	850	3.60	3,060	1,353	8.80	11,906	15,786	15,786
1980	-	-	-	844	950	3.60	3,420	1,687	8.80	14,846	19,110	19,110
1981	-	-	-	870	1,050	3.60	3,780	2,040	8.80	17,952	22,602	22,602
1982-1998	-	-	-	896	1,150	3.60	4,140	2,340	8.80	20,592	25,628	25,628

Economic Return = 22.8%

1/ Other units are used as they are necessary; those are specified in the table.
2/ Savings on KNR operating costs are calculated by (i) excluding the suburban and industrial line costs; (ii) excluding part of depreciation costs incurred newly by the investment plan; and (iii) assuming increase in operating costs annually by, say, 3%.
3/ Passenger-km diverted to road is calculated by assuming the capacity of long distance passenger traffic being 8.5 billion pass-km "without project."
4/ The unit cost is same as one used in Table 2 in this Annex.
5/ Freight ton-km diverted to road is calculated by (i) excluding the freight diversion taken into account in the industrial line electrification analysis and (ii) assuming the most of freight diverted to road being general goods.
6/ The unit cost is assumed to be the average of the 25-ton expressway truck fully loaded and of 8-ton truck fully loaded.

October 1972

TABLE 3 TO ANNEX 9

KOREA

FOURTH RAILWAY PROJECT

Principal Assumptions - Financial Forecasts

The financial projections are based on the following principal assumptions:

1. The freight and passenger traffic forecasts (Tables 4 and 5).

2. Increases of 3% per annum in material prices; no increase in staff remuneration levels during 1973 and 1975 and increase in such levels by 10% per annum during 1974 and 1976.

3. Reduction in staff strength by 1% in 1973 and no increase in staff strength thereafter. Reduction in fuel and maintenance costs on account of modernization and improvements covered by the Investment Plan.

4. Tariff adjustments of February 1972 taken into account - passenger and freight revenues shown in Table 17 are at 1972 tariff levels. Additional revenue to be secured by tariff adjustments is shown separately for each year. These revenues could be raised by freight tariff adjustments (on a selective basis) to yield an average increase of 20% each from January 1974 and January 1976; passenger and freight tariff increases from January 1975 adequate to provide additional revenues equal to that of 20% passenger tariff increase. If staff costs and prices increase beyond the annual increases referred to in 2 above, further adjustments would be made to compensate the higher costs to the extent such costs cannot be offset by lower expenses or greater traffic than included in the forecasts.

5. Results of revaluation of fixed assets not anticipated.

6. Foreign exchange rate of US$1 = 400 Won for debt service and investment.

7. Terms already finalized in regard to the amount allocated to KNR from the Special Yen Credit extended by Overseas Economic Cooperation Fund (OECF - Japan) to Korea, the terms of the loan from the consortium of European manufacturers in regard to the electrification of the industrial lines, and other existing debts; new KFW loan of about Deutsche Mark 13 million with 2% per annum rate of interest and 25 years repayment including five years grace; Government loans to KNR of 5.2 billion Won in 1972, 6.36 billion Won in 1973 and 5.2 billion Won during 1974 with interest at 6% and repayment in 20 years including five years' grace.

8. The proposed IBRD loan to be US$40 million equivalent with an interest rate of 7.25% per annum and repayment in 25 years, including a four-year grace period.

9. Foreign exchange requirements for 1975 and 1976, amounting to US$24.3 million equivalent to be arranged from international sources, with interest at 7.25% per annum and repayment in 25 years, with a four-year grace period.

October 1972

IBRD-3901 R
JUNE 1972